

Imaging Spine Injuries 2



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Thoracolumbar Compression Fracture

- Mechanism: flexion and/or axial load
- Stability: stable
 - Unless >50% anterior body height loss
- Vertebra will be wedged forever
 - Unless surgically modified
 - Vertebroplasty, kyphoplasty



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Thoracolumbar Compression Fractures

- 35%: female > 45 w/ postmenopausal osteoporosis
- 30%: secondary osteoporosis
 - Corticosteroids (15%)
 - Hyperparathyroidism (8%)
 - Malignancy (<2%)
- 25%: Acute trauma



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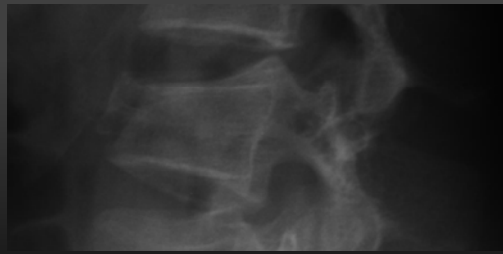
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Compression fractures

Shapes

- Wedge
- Biconcave (fish)
- Vertebra plana (collapsed)



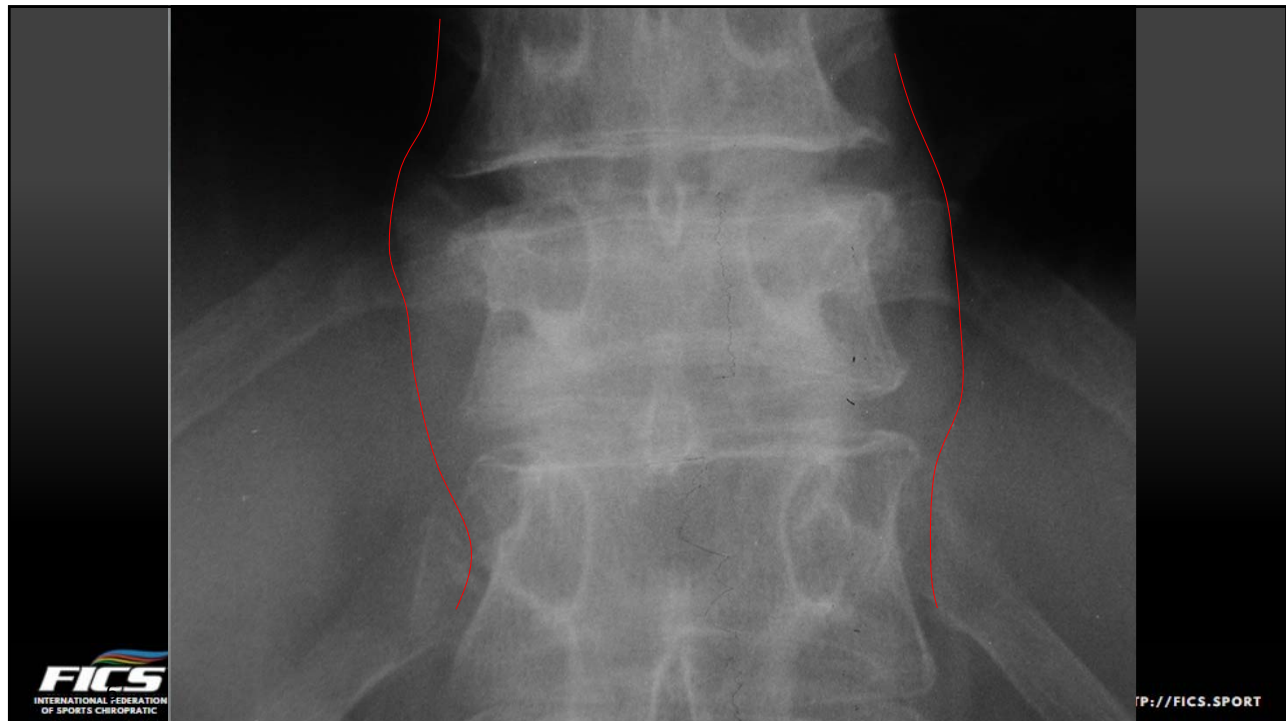
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Thoracolumbar Compression Fractures

Imaging findings

<u>Characteristic</u>	<u>New</u>	<u>Old</u>
Shape	Wedge	Wedge
Zone of impaction	Yes	No
Step defect	Yes	No
Paraspinal edema	Yes	No
Abdominal ileus	Yes	No
Disc degeneration	No	Yes
Positive bone scan	Yes	+/- 2 years
MRI marrow edema	Yes	No

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Abdominal ileus



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New vs. Old



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On Your DDX: Scheuermann's Disease

- aka Juvenile Kyphosis
- Strong familial component
- Cumulative endplate trauma in adolescents
 - 13-17yo
 - Weightlifting, gymnastics, etc
- Results in disturbance to endplate growth



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Scheuermann's Disease

- 3 or more segments w/ 5 degrees or greater anterior wedging
- Frequent Schmorls nodes
- Hyperkyphosis



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Thoracolumbar Burst Fractures

- Mechanism: Flexion and/or axial load
- Stability: unstable
 - Involves 2-3 columns
- Neurological injury - up to 50%



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Thoracolumbar Burst Fractures

- May look like compression fracture, but other possible additional findings:
 - Retropulsion of middle column body fragments
 - Vertical splitting of body
 - Comminution of body
 - Focal widening of the interpedicle distance
 - Indicates posterior element Fx

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Thoracolumbar Burst Fractures

- Follow up:
 - Stabilize patient, have them transported by ambulance
 - CT for osseous fragments
 - MRI most useful for cord / nerve root damage



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Schmorl Nodes

- Intravertebral disc herniation
- M/C occur during pubescent growth spurt, and are ASx
- Can be traumatic and painful
- No way to make the distinction on x-ray



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Limbus Bones

- Variant of the Schmorl node
- Nuclear material separates a portion of the ring apophysis, heals non-union
- See a small usually triangular fragment
- Can occur anterior (M/C), lateral, posterior
- Posterior associated with central stenosis



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Posterior Limbus Bone

- Exception to Denis
- Involves ONLY the middle column
- Stable
- Concern for neuro compromise from stenosis



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Thoracolumbar Transverse Process Fractures

- Mechanism
 - Flank trauma or extension w/ lateral flexion
- 2nd MC lumbar Fx
- DDx ununited TP ossification center
- Ureter or kidney damage in 20%
 - With or without hematuria
 - Requires abdomen CT w/ IV contrast
- Heterotopic ossification
 - Lumbar osseous bridge syndrome (LOBS)

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Isthmic Spondylolysis

- Involves the pars interarticularis
 - L5 90%
 - L4 4%
 - L1, L2, L3 3%
- 3 subtypes
 - 2A: Fatigue fracture of the pars (MC)
 - a.k.a. spondylolytic
 - 2B: Elongating but intact pars
 - 2C: Acute traumatic pars fracture (rare)



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Isthmic 2A (Spondylolytic) Spondylolisthesis

- MC type of spondylolisthesis in people under age 50
- Due to a fatigue Fx of the pars that heals non-union
 - NOT congenital
 - CAN have spondylolysis WITHOUT spondylolisthesis
- Pars fracture vs pars defect terminology

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Isthmic 2A (Spondylolytic) Spondylolisthesis

- Incidence :
 - 17% in athletes (range of other populations is 2-40)
 - Pts with SBO have 13x greater incidence than those without
- Theory for differences in incidence is related to the thickness of the pars
 - Thinner pars are more susceptible to fatigue Fx

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Isthmic 2A (Spondylolytic) Spondylolisthesis

- A series of unfortunate events
 - Adolescent patient (10-15)
 - Repetitive hyperextension loads
 - Fatigue fracture of the pars interarticularis
 - Continuation of activity
 - Resultant non-union healing



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Isthmic 2A (Spondylolytic) Spondylolisthesis

- Patient histories to make you go HUMM...
 - Gymnast
 - High diver
 - Cheerleader
 - Weight lifting
 - Pole vaulting



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Imaging the Adolescent

- If there is suspicion of active pars fatigue Fx
 - X-ray first
 - Classically AP, lateral. Hold obliques unless needed.
 - Better choice for L5 – Fergusons (tilt up) view
 - MRI or SPECT scan
 - DO NOT order a planar bone scan, SPECT is 20x more sensitive
 - MRI give the information without radiation
 - SPECT is 3 REM to the gonads
- If positive for active defect, off activity and Boston brace

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Radiographic Findings

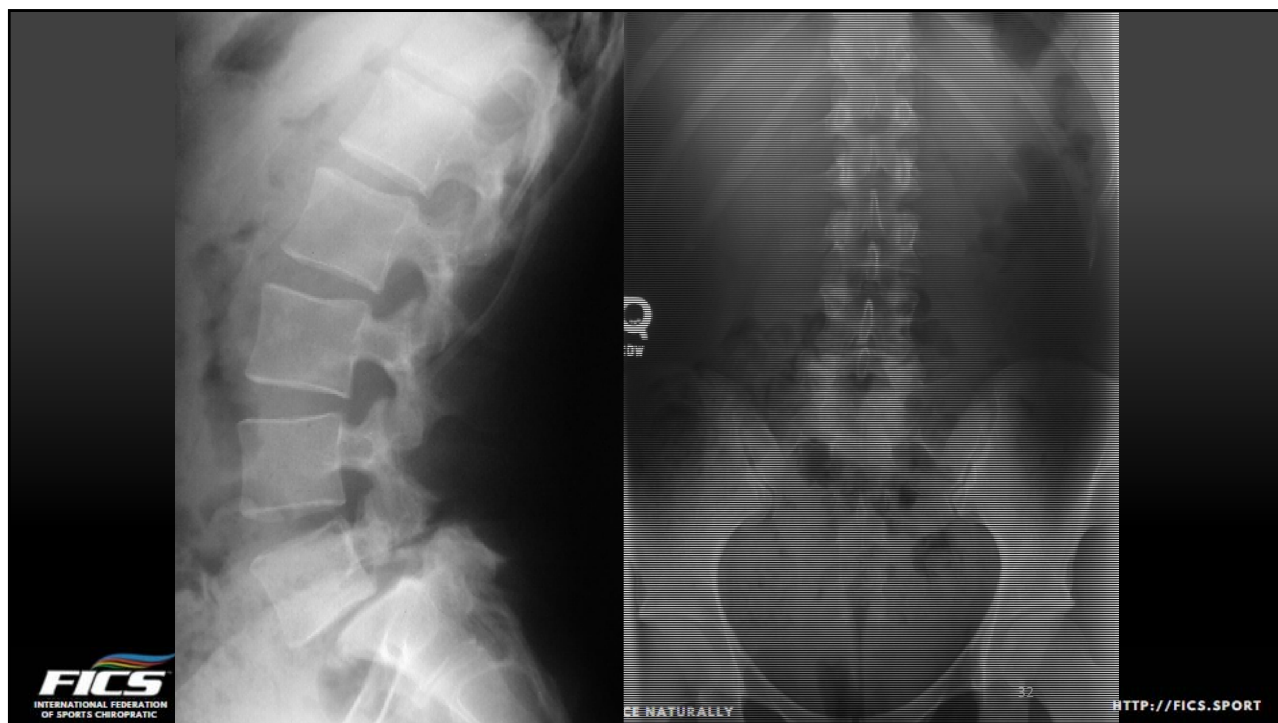
- The Scotty Dog
- The pars is the neck, look for the defect there



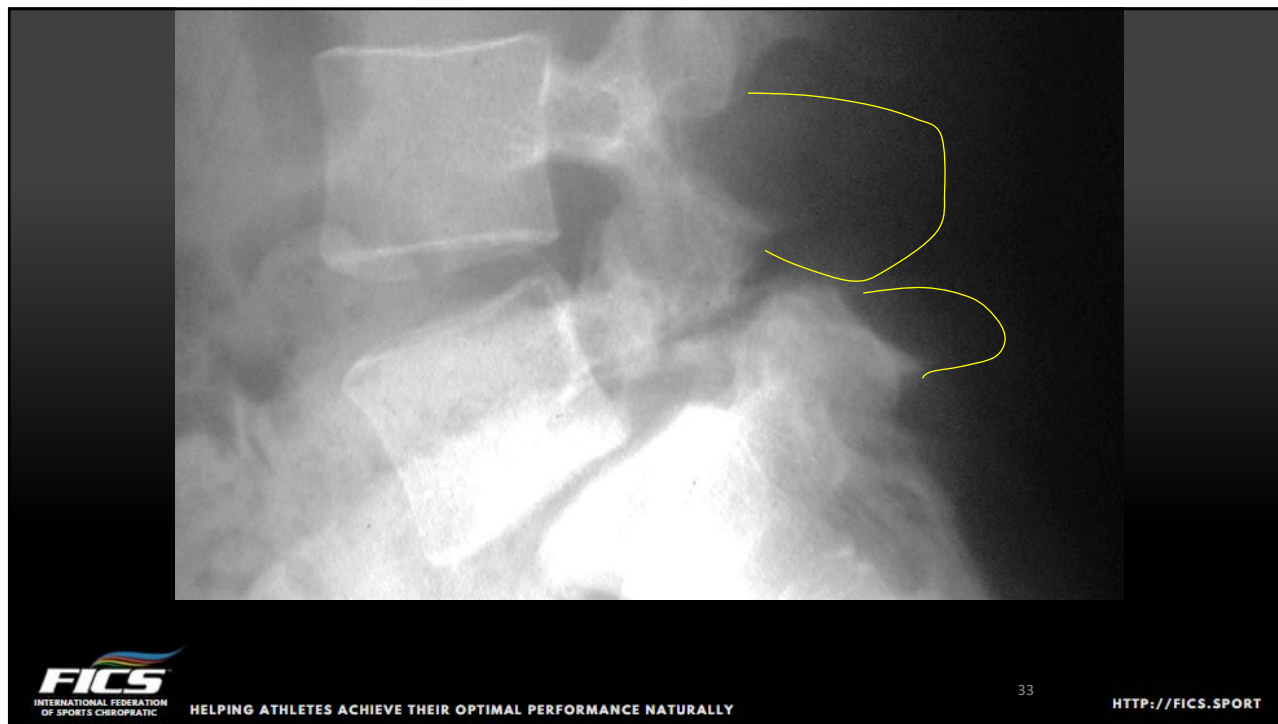
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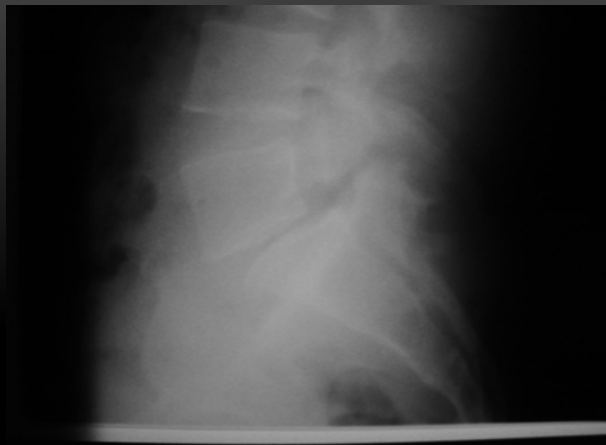
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Isthmic 2A (Spondylolytic) Spondylolisthesis

- Indicators of possible progression
 - Only 2-3% progress
 - Progression is more likely within 2 years of Fx
 - Poor response to conservative management
 - Serial progression of the slippage
- Indicators of possible instability
 - Higher grade slips are more likely to be unstable
 - Rounding of the sacral base (doming)
 - Trapezoidal shape to L5
 - Patient description of feeling unstable

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Trapezoidal Body



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Rounding of the Sacral Base



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Buttressing



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Isthmic 2B (Elongation) Spondylolisthesis

- A cycle of fatigue Fx – healing – fatigue Fx
- The cycle of Fx/healing allows for lengthening of the pars w/o overt defect



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Isthmic 2C (Acute Fx) Spondylolisthesis

- Rare
- Secondary to acute hyperextension
- Often has related injuries
 - e.g. compression Fx
- Can be a hard call on conventional radiographs
 - Need a CT or MRI for determination



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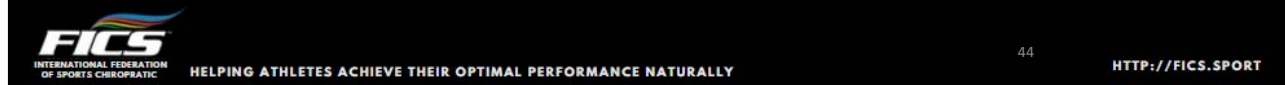
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Unilateral spondylolysis

- Less common than bilateral
- Frequently overlooked on imaging
- May heal or progress to bilateral defects
- No spondylolisthesis visualized



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Unilateral spondylolysis



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Sacrococcygeal Injuries

- Sacral stress fractures
- Vertical sacral fracture
- Horizontal sacral fracture
- Sacrococcygeal joint injury
- Coccyx fracture

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Sacral Fractures

- Mechanism: fall from height, side impact
- Stability
 - Stress: stable
 - Vertical: possibly unstable
 - Horizontal: stable



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Sacral Stress Fractures

- Stress (Fatigue) Fractures
 - Marathon running events
 - Typically vertical through the sacral ala
- Insufficiency Fractures
 - Osteoporotic individuals
 - Vertical and / or horizontal components
 - If both, "H" sign or "Honda" sign

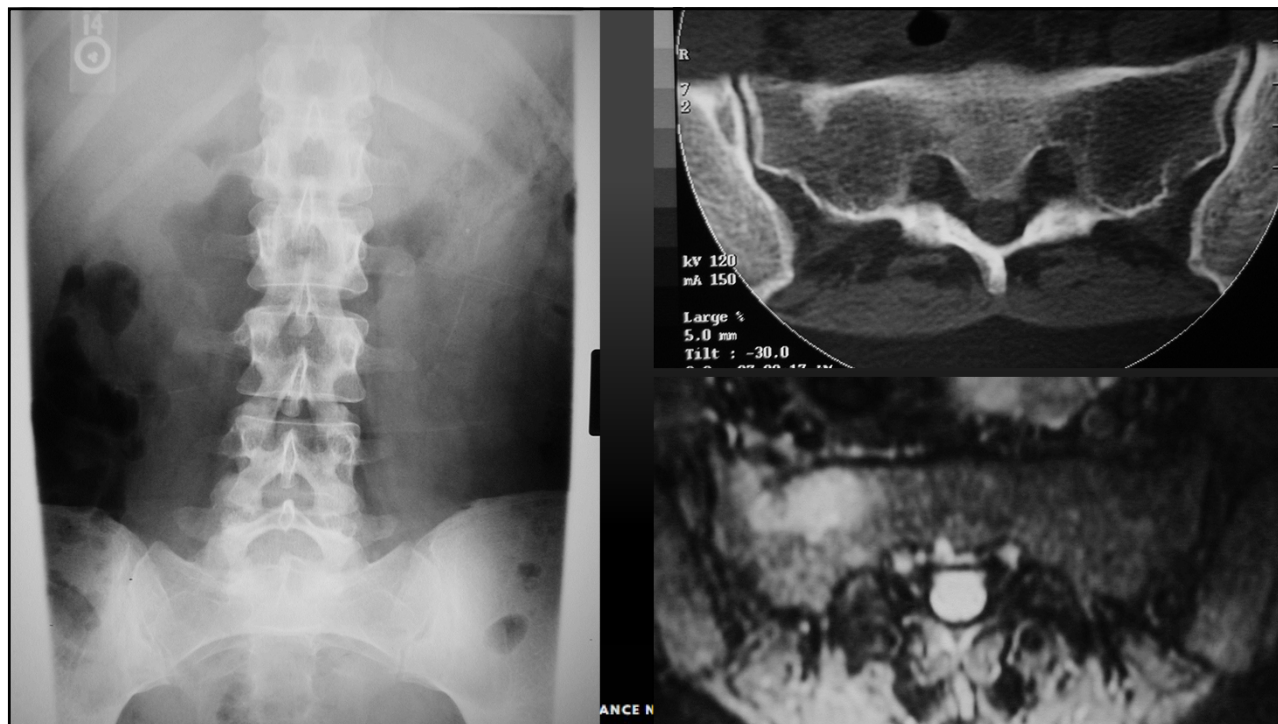


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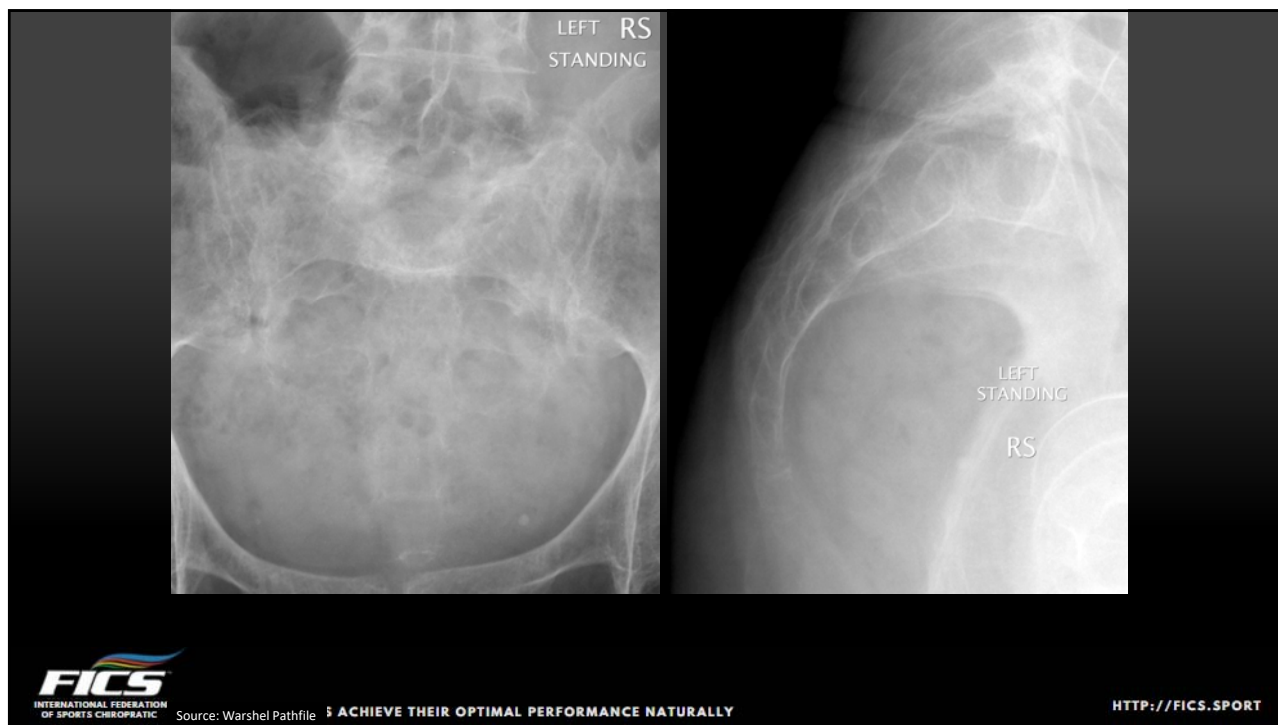
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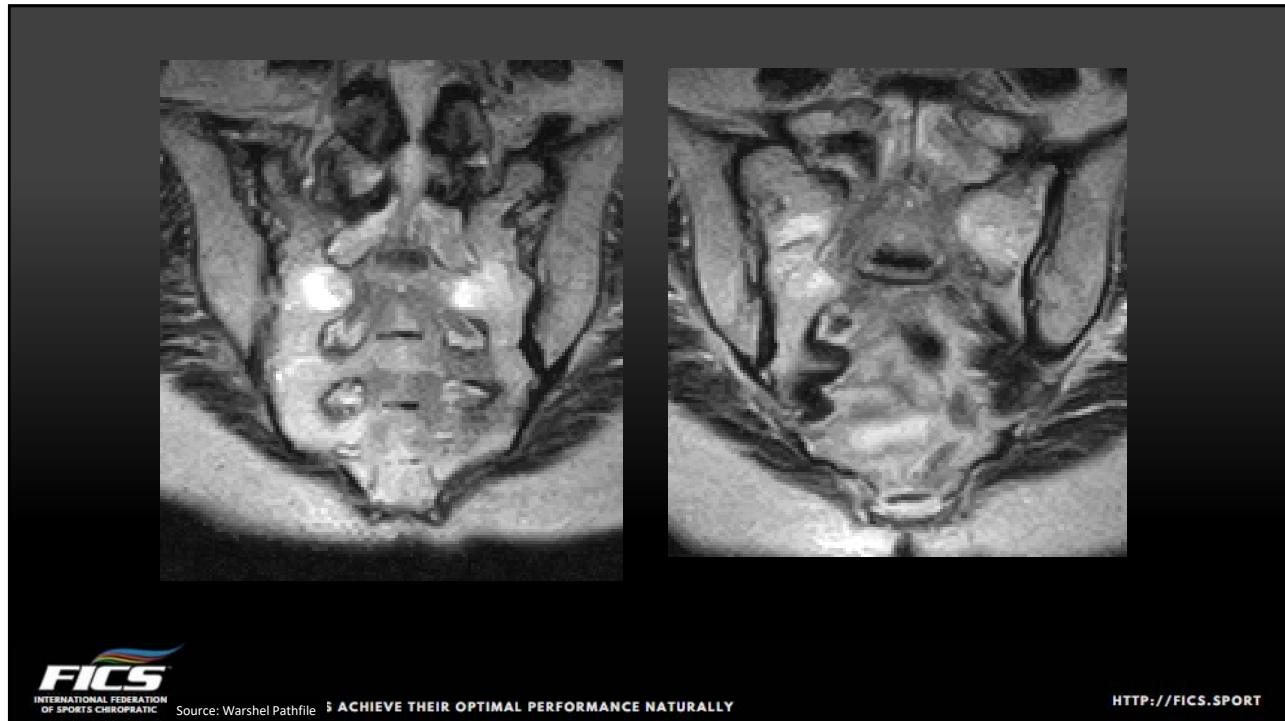
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Horizontal Sacral Fractures

- Horizontal/transverse fractures
 - Seen best on lateral view
 - 3rd & 4th sacral level below SI joint
- Hard to see, look at presacral space
 - < 5mm children, <20mm adults
- Isolated fracture is stable



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Vertical Sacral Fractures

- **Vertical fractures**
 - Indirect trauma to pelvis
 - 50% pelvic organ damage
 - Visible on AP only
 - Invisible on lateral
 - Disruption or distortion of sacral foramina



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Coccygeal injuries

- Most fractures are transverse
- Anterior displacement common
- May also subluxate or dislocate sacrococcygeal joint
- Best seen on lateral view



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Thoracic cage injuries

- Rib fractures
- Sternal fractures
- Complications



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Rib fractures

- Adult and geriatric
 - Uncommon in children
- Often radiographically occult
 - Bone scan, DxUS more sensitive
- Most involve ribs 4-9
 - Ribs 1-3 rarely fracture
 - Weight lifters - bench press - 2nd rib fracture
 - Throwing athletes, golfers, asthmatics, heavy back packs - 1st rib fatigue fracture



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Imaging Rib Fractures

- Take dedicated rib radiographs!!
- DO NOT RELY
 - on a thoracic with open collimation
 - on a CXR
- Minimum 2 views
 - 1 frontal (AP or PA) and 1 oblique
 - Extra spots with surface markers very common
 - Imaging the hemithorax
 - Must visualize either rib 1 or rib 12



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Rib Fractures: Imaging Findings

- Radiolucent fracture line
 - Use superior cortex
- Cortical offset – SUPERIOR margin
- Altered rib orientation
- Extrapleural sign
 - Swelling displacing the lung
- Callus
- Diaphragm elevation (splinting)



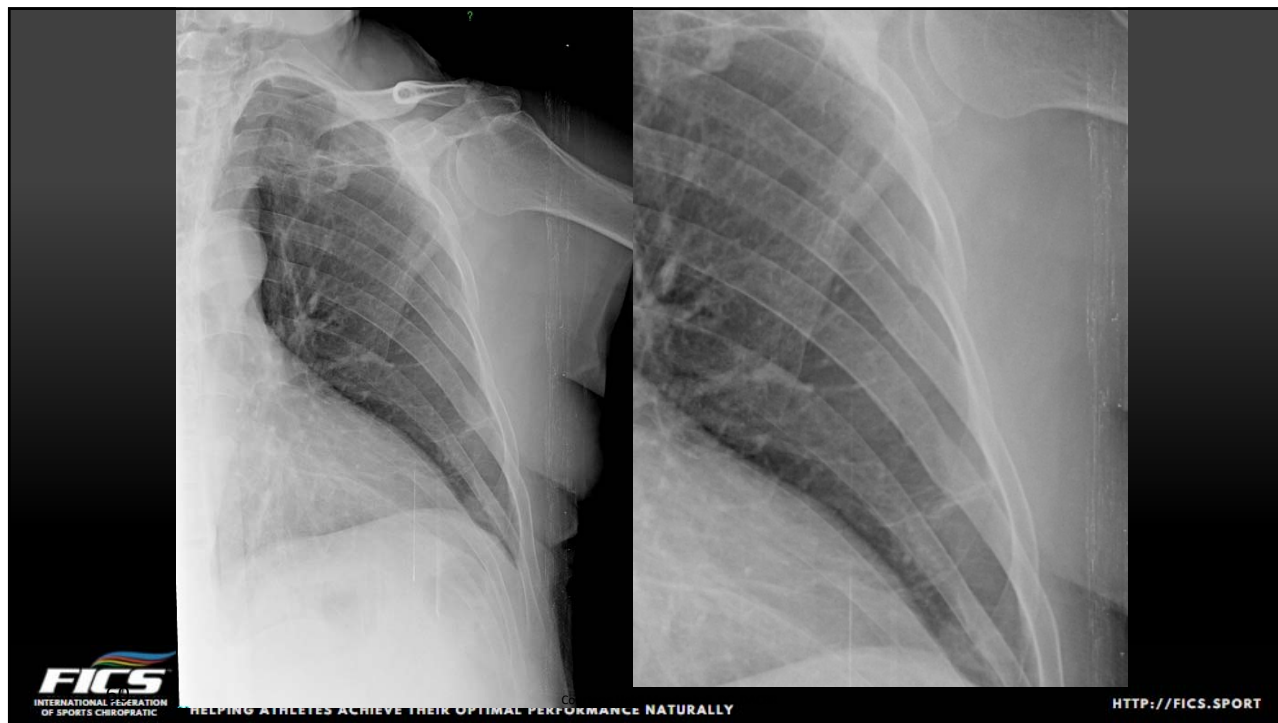
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Extrapleural Sign



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Sternal Fracture

- Blunt trauma
 - Steering wheel
 - Shoulder belt
- Transverse fracture MC
- Gladius for Fx
- Manubriosternal diastasis
- CT or MRI F/U



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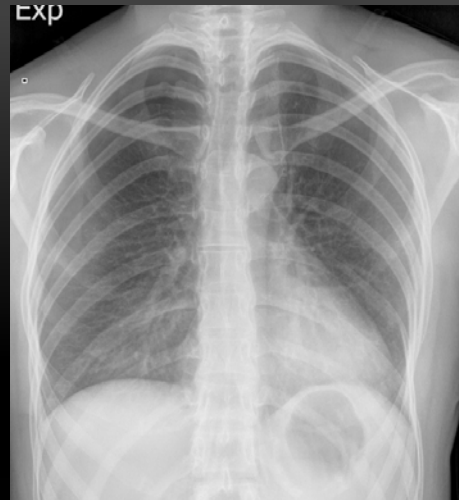
Complications of Thorax Trauma

- Pneumothorax
- Hemothorax
- Chylothorax
- Lung contusion
- Diaphragmatic rupture
- Aortic rupture
- Tracheal rupture
- Etc.

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Pneumothorax

- Separation of the parietal and visceral pleural by air
 - Can see the visceral pleural line
- Spontaneous in some conditions
 - Marfans, Ehlers Danos
- Secondary from underlying lung disease
- Post-traumatic
 - Rib Fx, barotrauma (divers)



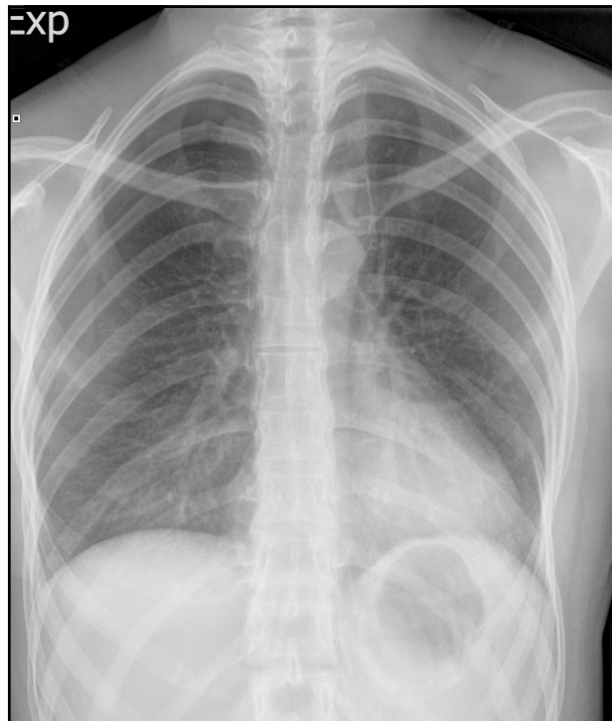
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End of Spinal Trauma 2



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