

Back To Chiropractic CE Seminars

Back to Basics: X-Ray ~ 6 Hours

Welcome to Back To Chiropractic Online CE exams:

This course counts toward your California Board of Chiropractic Examiners CE & your Radiography Supervisor & Operator Permit.

(also accepted in other states, check our website or with your Chiropractic State Board)

The California Board requires that you complete all of your CE hours BEFORE the end of your Birthday month. We recommend that you send your chiropractic license renewal form and fee in early to avoid any issues.

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Exam Process: Please read all instructions before starting!

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- 7. Upon passing the exam you'll be able to immediately download your certificate, and it'll also be emailed to you. If you don't pass, you can repeat the exam at no charge.**

Please retain the certificate for 4 years.

If you get audited and lose your records, I'll have a copy.

I'm always a phone call away... 707.972.0047 or email: marcusstrutzdc@gmail.com

Marcus Strutz, DC

Back To Chiropractic CE Seminars

CERVICAL, THORACIC & LUMBAR SPINE

Back to Basics

Jennifer Pedley, MS, DC, CCSP, DACBR
Chiropractic Radiologist

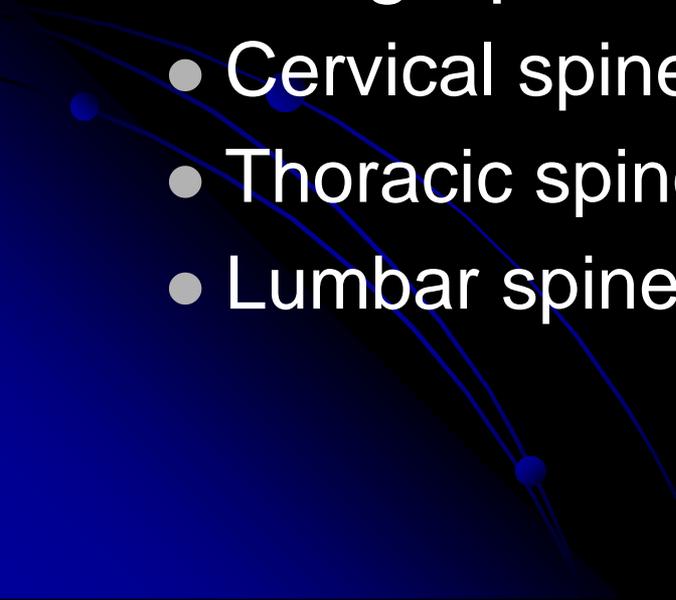
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- Radiographic Positioning & Factors

- Cervical spine
- Thoracic spine
- Lumbar spine

- Radiographic Evaluation— *tools you can use*

- Cervical spine
 - Thoracic spine
 - Lumbar spine
- 

Cervical Spine Views

3 Views-

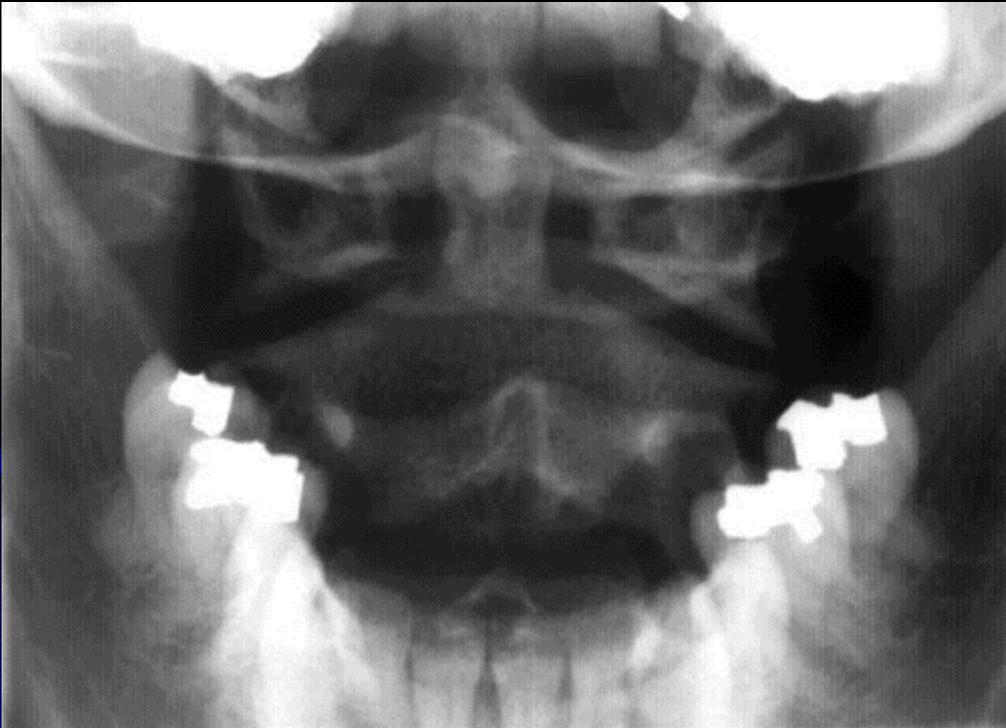
- APOM, AP lower cervical, and neutral lateral performed first; standard views
- If needed, Followed by extended and flexed lateral views>>> evaluate for ligamentous laxity and/or instability
 - Oblique views are helpful in evaluating the intervertebral foramina

APOM

- **FFD** 40"
- **CR** uvula; if needed, 5 degree with cephalad tube tilt
- **Collimate** 5x5



AP OPEN MOUTH



Structures Visualized:

- Dens
- C1 lateral masses
- Occipital Condyles
- C2 body
- C2 SP

AP Lower Cervical

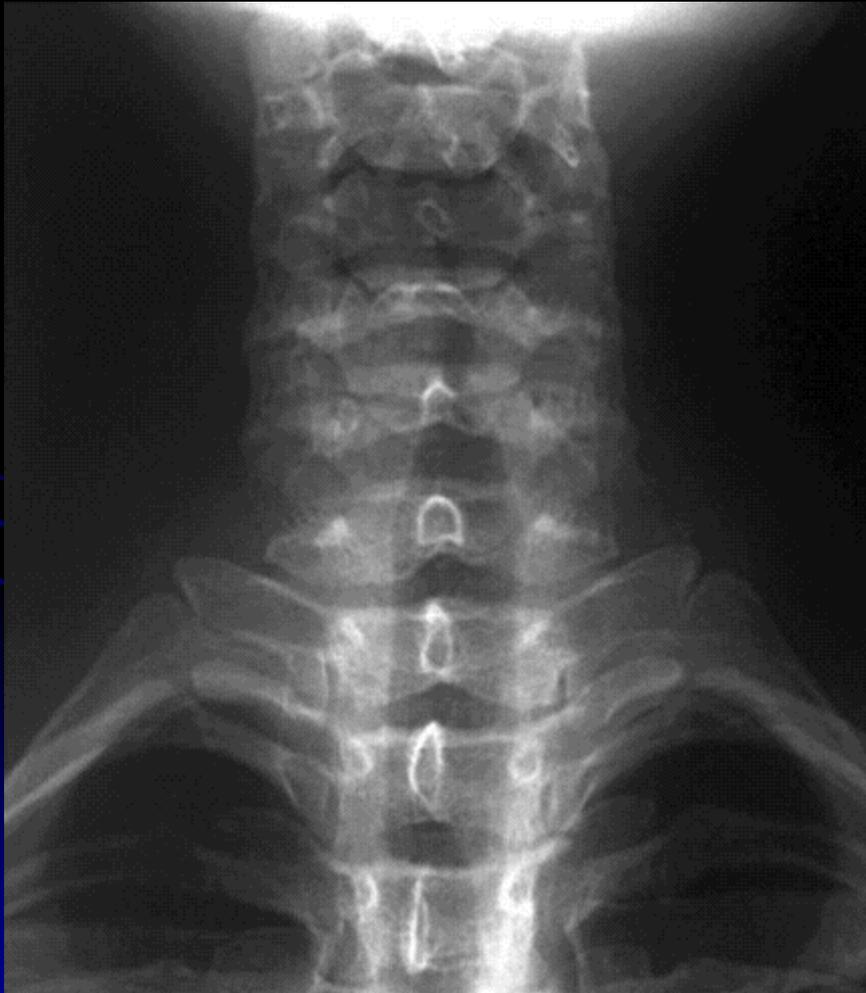
- FFD 40-3"
- **Tube Tilt 15°**
cephalad
- CR C3/4
(thyroid cartilage)
- Collimate 7x10



Tube Tilt Rule

- For every 5 degrees of tube tilt, move xray tube one inch closer to the patient
- 15 degree tube tilt= move tube closer by 3 inches (40 inches to 37 inches)

AP LOWER CERVICAL



Structures Visualized

- Vertebral Bodies
- TP's
- SP's
- Upper Ribs
- Upper Lung Fields
- Uncinate Processes
- Tracheal Air Shadow

NEUTRAL LATERAL

- **FFD 72"**

- **CR C3**

- **Collimate 7X10**



LATERAL CERVICAL



Structures Visualized

- Vertebral bodies C2-T1
- Disc Spaces
- ADI
- SP's, Lamina, Pedicles,
- Articular Pillars and Facets
- Tracheal Air Shadow
- George's Line & Spino-laminar line
- Sella Turcica
- C1 Arches

LATERAL EXTENDED

- FFD 72"
- CR C3
- Collimate 8x10
- May need to be landscape in patients with greater range of motion



LATERAL FLEXED

- FFD 72"
- CR C3
- Collimate 8x10
- May need to be landscape in patients with great range of motion



Posterior vs. Anterior Obliques

Posterior

- Visualize the opposite IVF's
- Example: Left posterior oblique radiograph, visualizes the right IVF.

Anterior

- Visualize the same side IVF's
- Example: Right anterior oblique radiograph, visualizes the right IVF.

LEFT ANTERIOR OBLIQUE

- FFD 72"

- CR C3

- Tube tilt 15 °
caudad**

- Collimate 7-8x10



LEFT POSTERIOR OBLIQUE

- FFD 72-3"
- CR C3
- **Tube tilt** 15 °
cephalad***
- **Collimate** 7-8x10



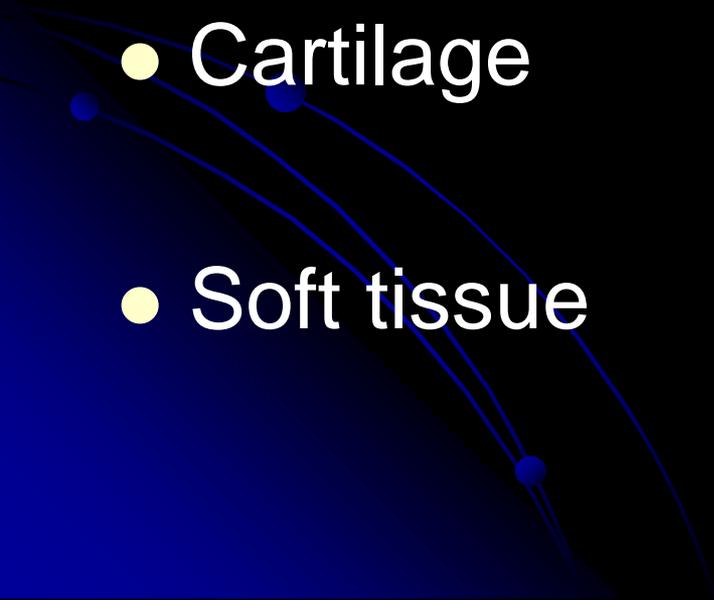
CERVICAL OBLIQUE



Structures Visualized

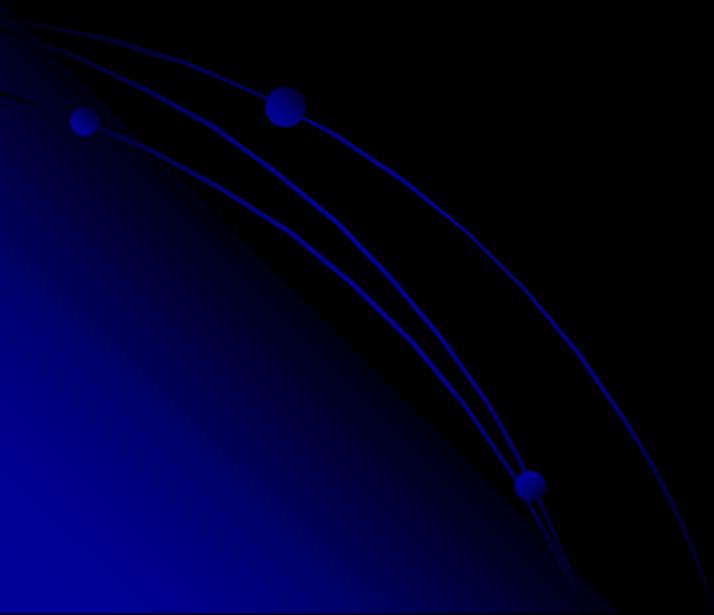
- IVF's- should be open and about the same size at every level.
- Vertebral Bodies
- C1 arches
- Ribs
- SP's
- Facets

Evaluation: ABC'S

- Alignment
 - Bone
 - Cartilage
 - Soft tissue
- 

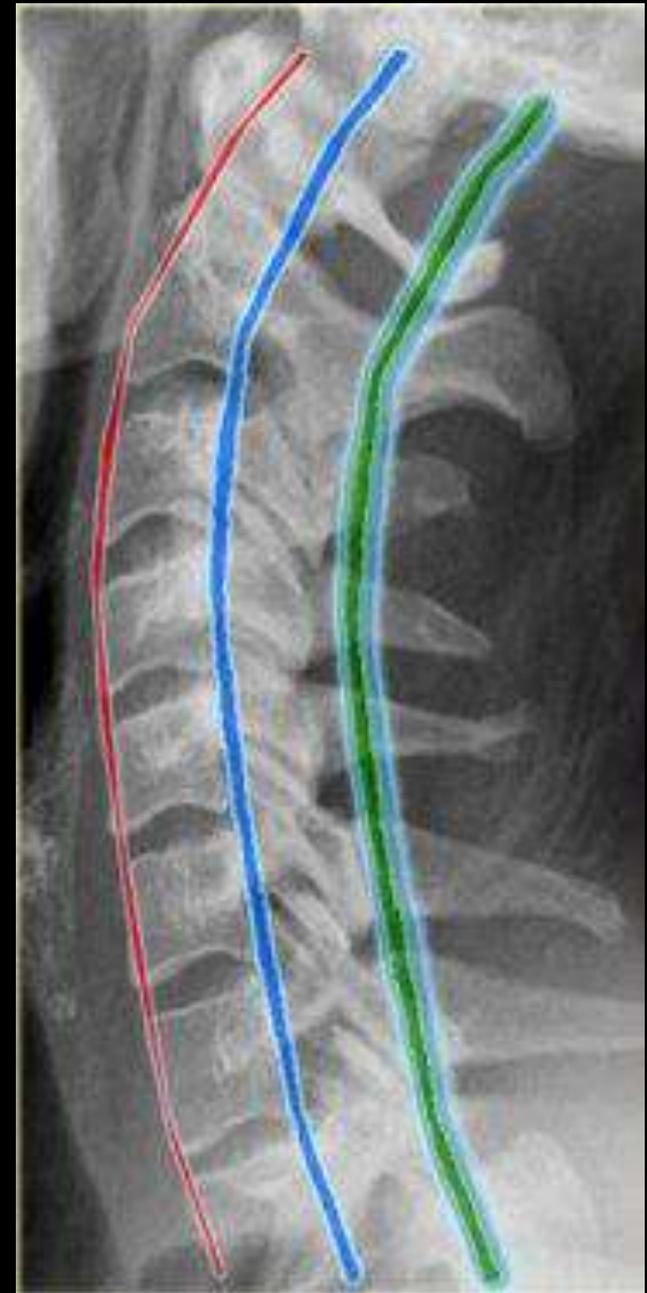
Alignment- ABC's

- Lines of interest
- Posture
- Lordosis



Lines of Interest

- Spinolaminar line (green)
 - Posterior cervical line (blue)
 - Anterior cervical line (red)
- These lines should draw in a smooth arc. If there is disruption of these lines, then further evaluation of the bony structures is required.



Radiographic Signs of Instability- (Evaluate on the lateral radiographs)

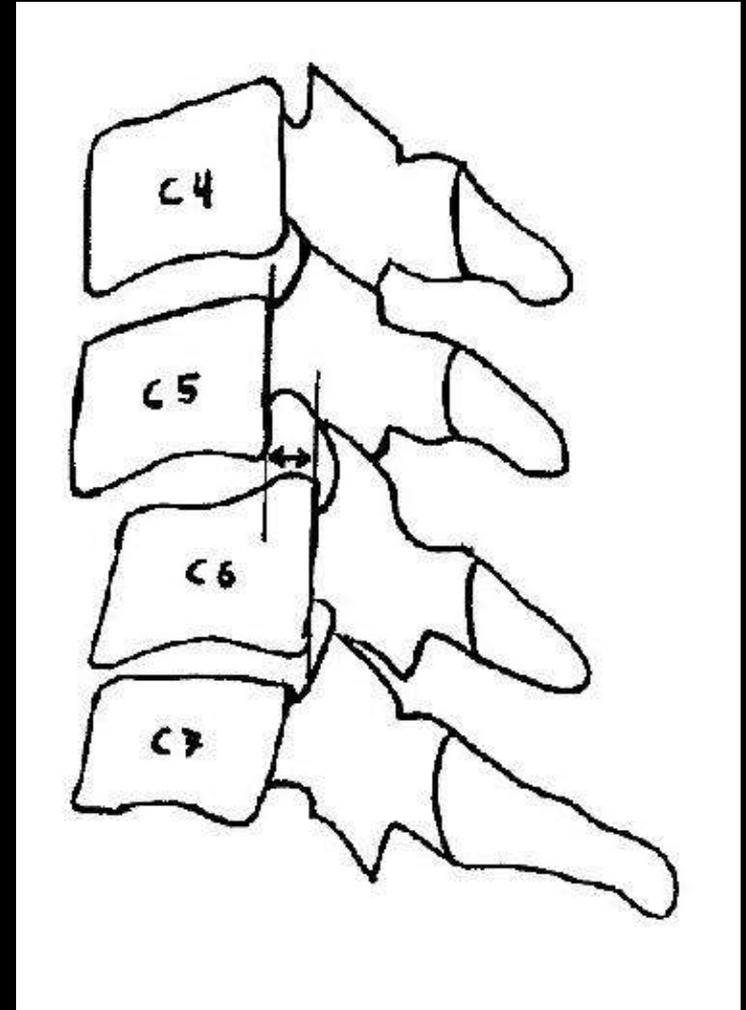
- Vertebral body displacement >3-3.5mm
- Greater than 11 degree angulation
- Widened interlaminar & interspinous space
- Widened facet joints
- Widened interpediculate distance (AP view)
- Atlanto-dental interspace >3mm adults; >5mm in children

These findings indicate skeletal, ligamentous and articular disruption.

Measuring Intersegmental Translation- compare to the level below

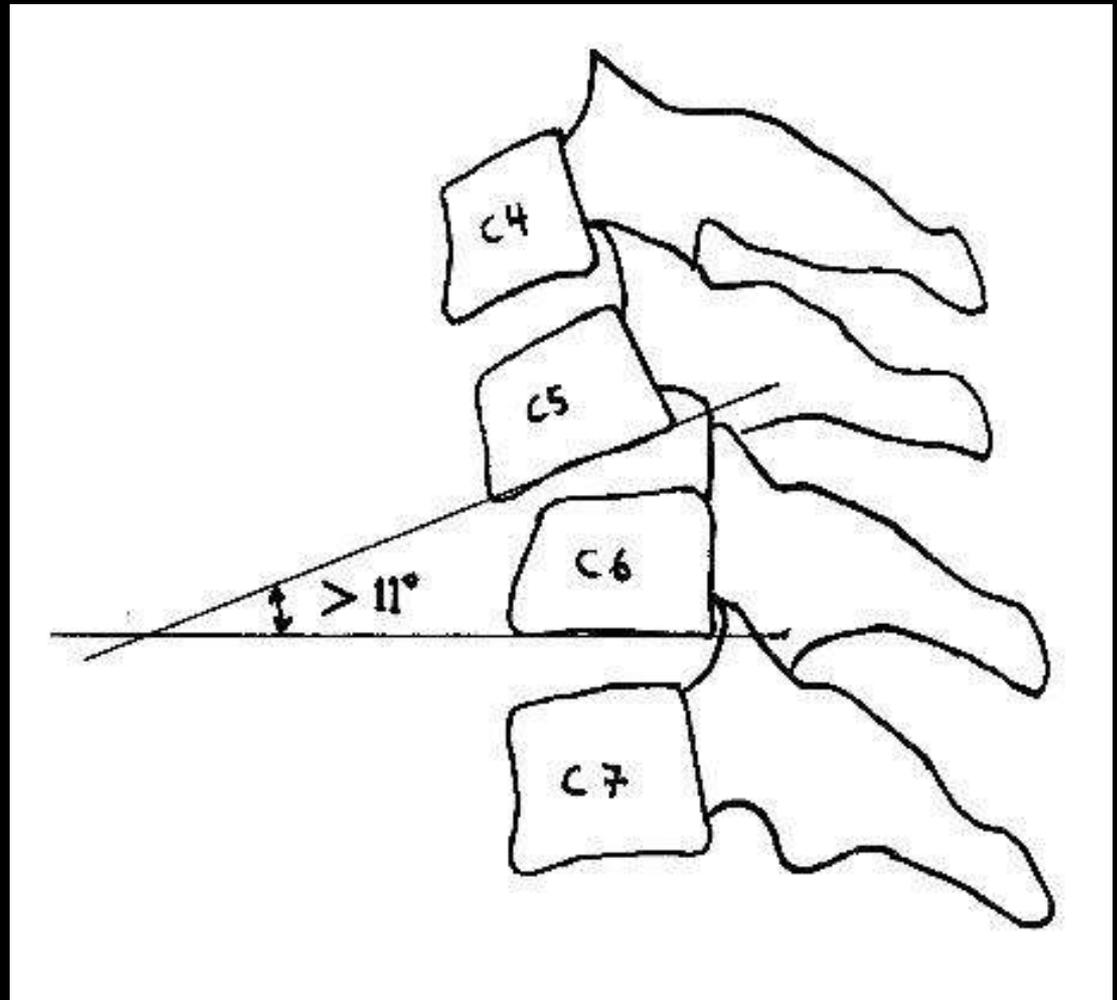
Greater than 3-3.5 mm of vertebral body motion= ligamentous instability

Need to compare the flexed and extended lateral to the neutral lateral radiograph.



Measuring Angulation

- Lines drawn on the Inferior endplates.
- Greater 11 degrees = ligamentous instability



Other Evaluation Tips

- Spinous processes should be equidistant
 - If widening or increased distance, indicator of interspinous ligament injury/disruption.
- Facet joints imbricated (stacked on top of each other 😊)

More Evaluation

ADI-atlantodental interspace:

- V-shaped is normal
- Indicator of ligamentous instability (Transverse Ligament) with widening of the ADI on the Neutral lateral, or on the Flexed lateral, or on the Extended lateral.
 - Greater than 5mm in children & greater than 3mm in adults

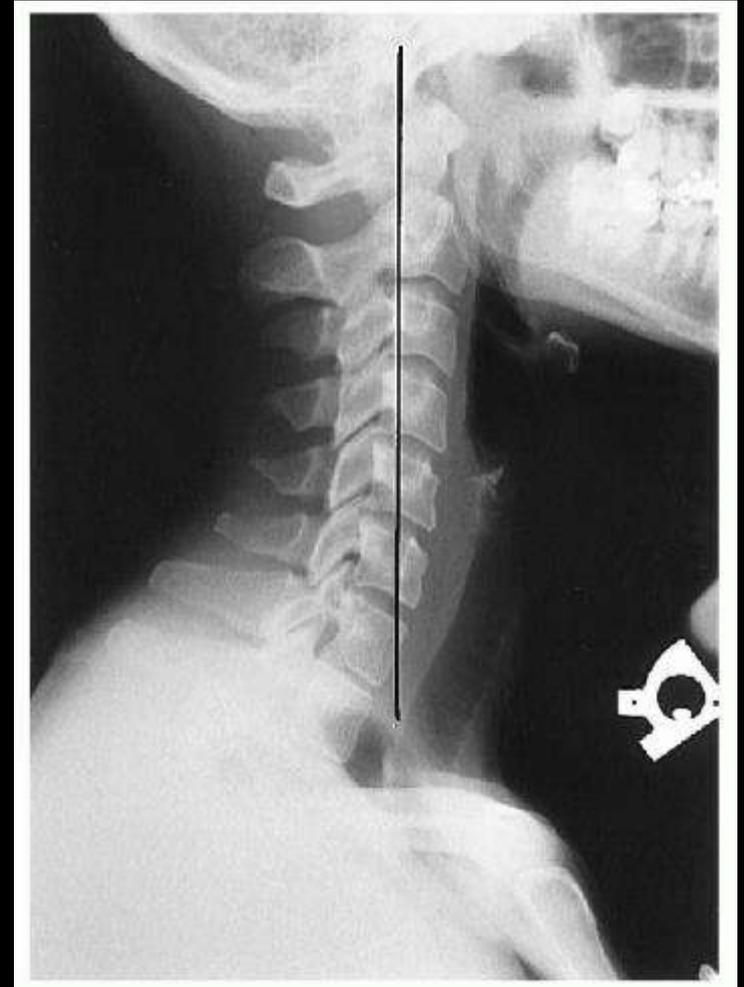
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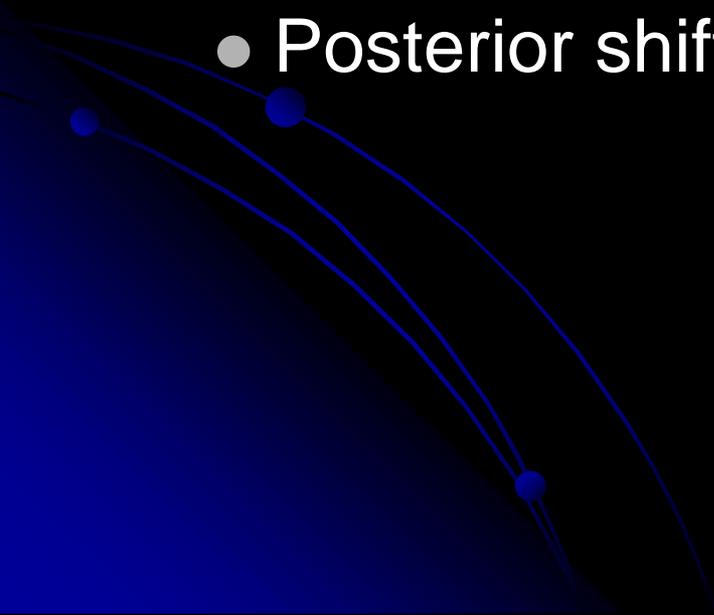
Evaluation

- Cervical Gravity Line: Vertical line through apex of odontoid, should intersect C7



Cervical Gravity Line

- Gravity line anterior to C7
 - Anterior shift in weightbearing
- Gravity line posterior to C7
 - Posterior shift in weightbearing



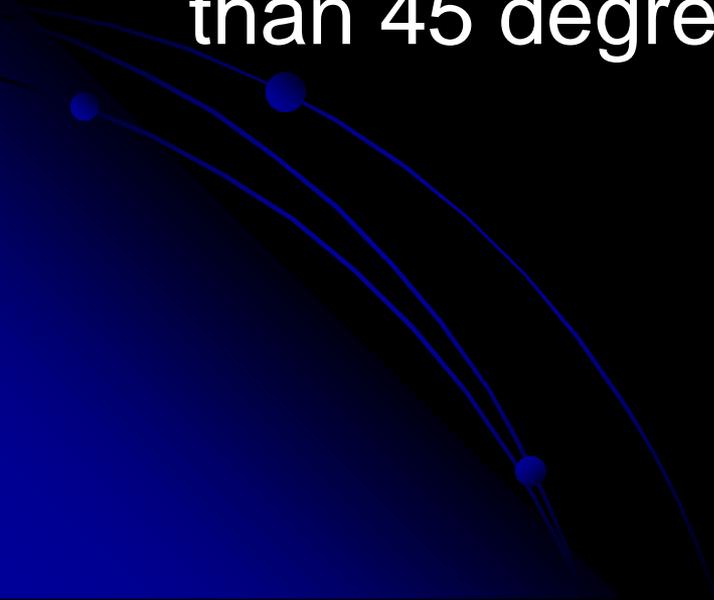
Evaluation

- Cervical Lordosis
Angle: Normal 35-45 degree
 - In this case, mild anterior shift in weightbearing



Lordosis Angle

- Hypolordosis- loss of or straightening of the normal lordosis, less than 35 degrees.
- Hyperlordosis- increased lordosis, greater than 45 degrees.

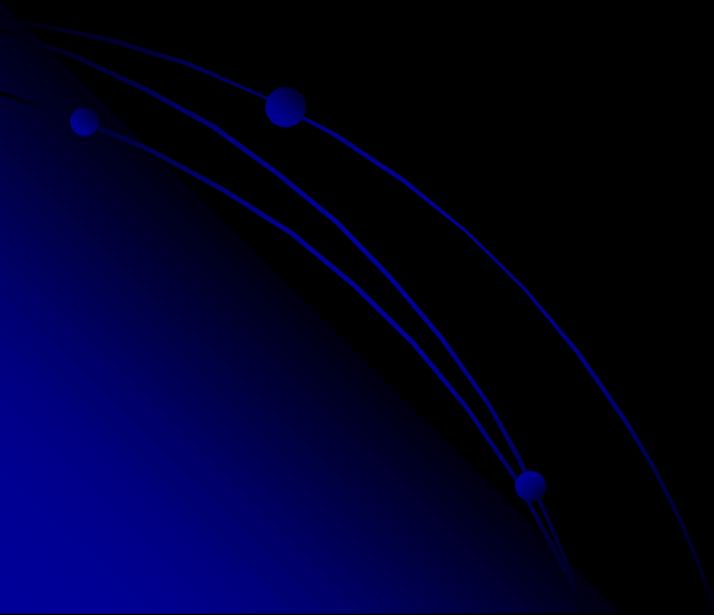


Bone- ABC's

- Cortex
- Shape and size of the vertebral bodies
 - Should be same size at every level
 - Example: compression deformity= trauma or pathologic from age related osteoporosis, primary bone tumor or mets
- Pedicles and spinous process
 - Make sure they are there!!
 - Equidistant to each other
- Intervertebral foramina

Bone- continued

- Lateral masses of C1 and Dens of C2
 - Normal in shape and size with intact cortex

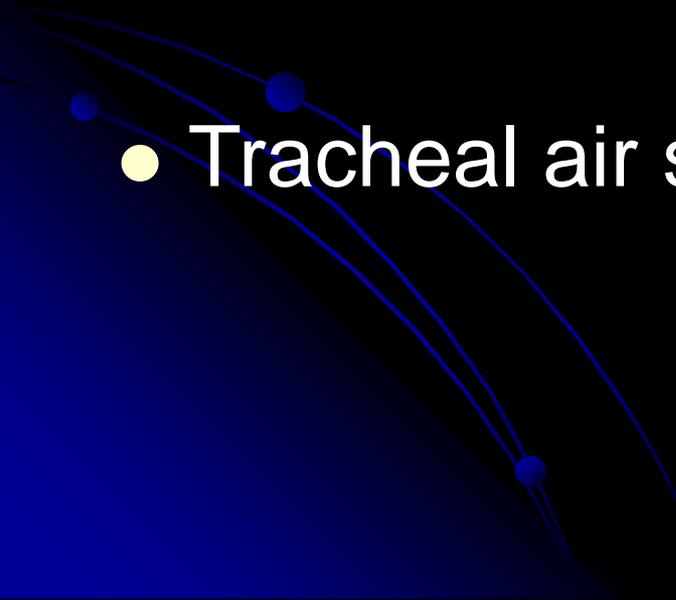


Cartilage-ABC's

Joints:

- Facet & Uncovertebral joints
 - Shape, size and density
 - Example: Sclerosis, narrowing and hypertrophied= degenerative joint disease
- Intervertebral discs
 - Size
 - Example: Disc narrowing with/without spondylophytes= degenerative disc disease

Soft Tissue- ABC's

- Prevertebral or anterior soft tissues of the cervical spine
 - Normal calcifications within the soft tissues
 - Tracheal air shadow & Upper lung fields
- 

Lateral cervical spine

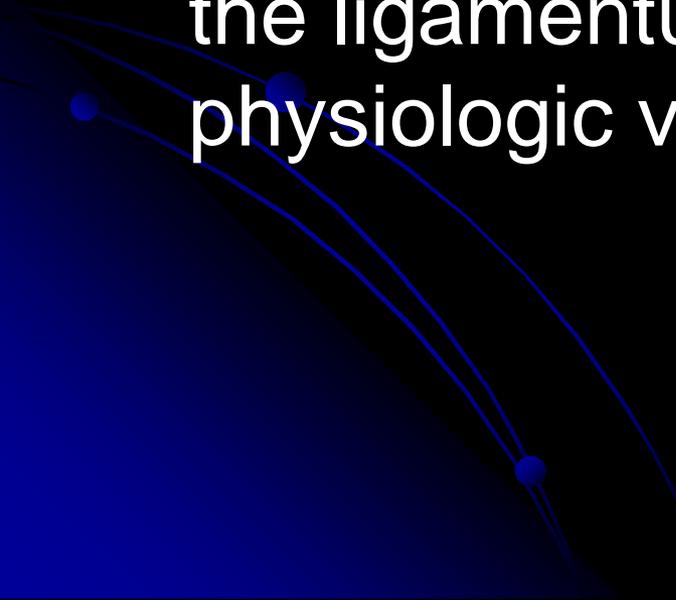
- Evaluate the anterior and posterior soft tissues
- Prevertebral (anterior) soft tissues:
 - Retropharyngeal: >7.0-mm
 - Retrotracheal: >22.0-mm



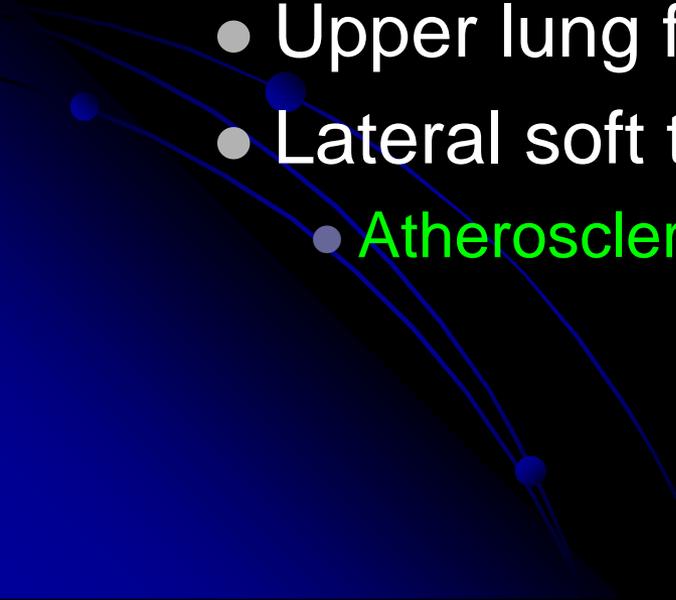
Prevertebral Soft Tissues

- Why do we need to look at them?
 - Widening of the anterior/ prevertebral soft tissue and/or increased density= **Differential diagnosis is edema due to trauma, infection, or a mass/tumor.**

Posterior Soft Tissues

- Don't miss fractures of spinous process when evaluating the soft tissues
 - Normal nuchal bones- calcification within the ligamentum nuchae, normal physiologic variant.
- 

Soft tissues-continued

- Normal calcification of the thyroid cartilage
 - AP radiograph of cervical spine
 - Tracheal air shadow
 - Upper lung field
 - Lateral soft tissues
 - Atherosclerosis of carotid arteries
- 

- Tracheal deviation to the right.
- The normal tracheal cartilage calcification is also deviated to the right.

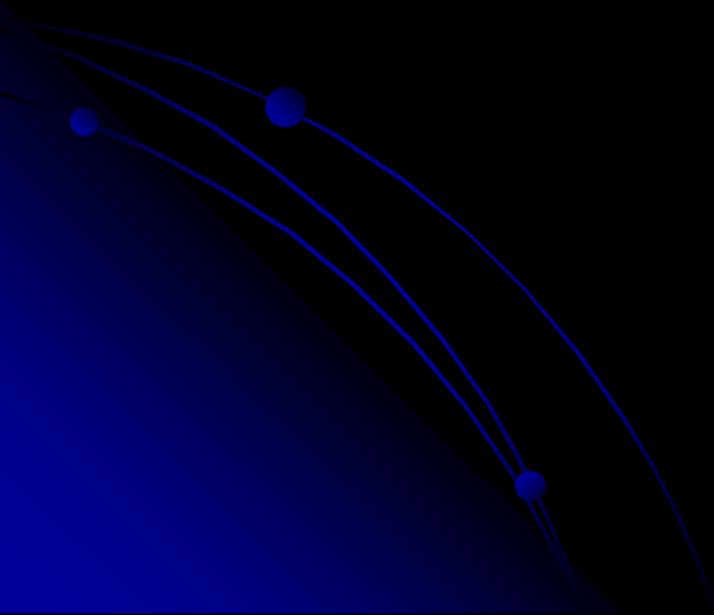


Atherosclerosis of bilateral carotid arteries



2 Views of the Thoracic Spine

- AP and Lateral views
- PA chest view is optional
 - With full inspiratory effort



AP Thoracic Projection

- FFD 40"

- CR T6

- Collimate 7x17



Lateral Thoracic View

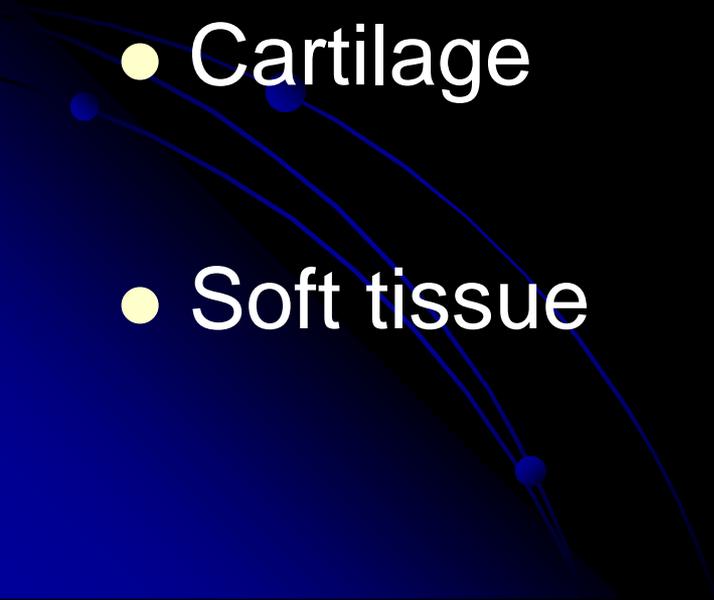
- FFD 40"
- CR T6
- Collimate 10x17
- Take image during expiration to blur out the ribs



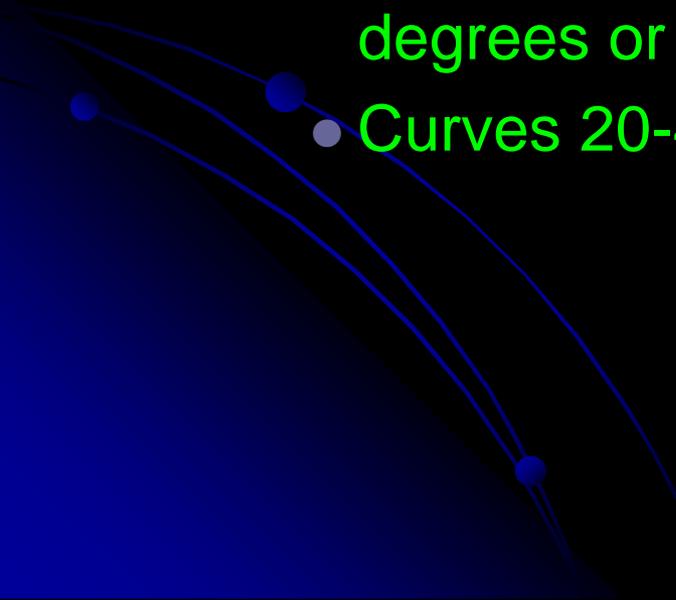
AP and Lateral Thoracic Views



Evaluation: ABC'S

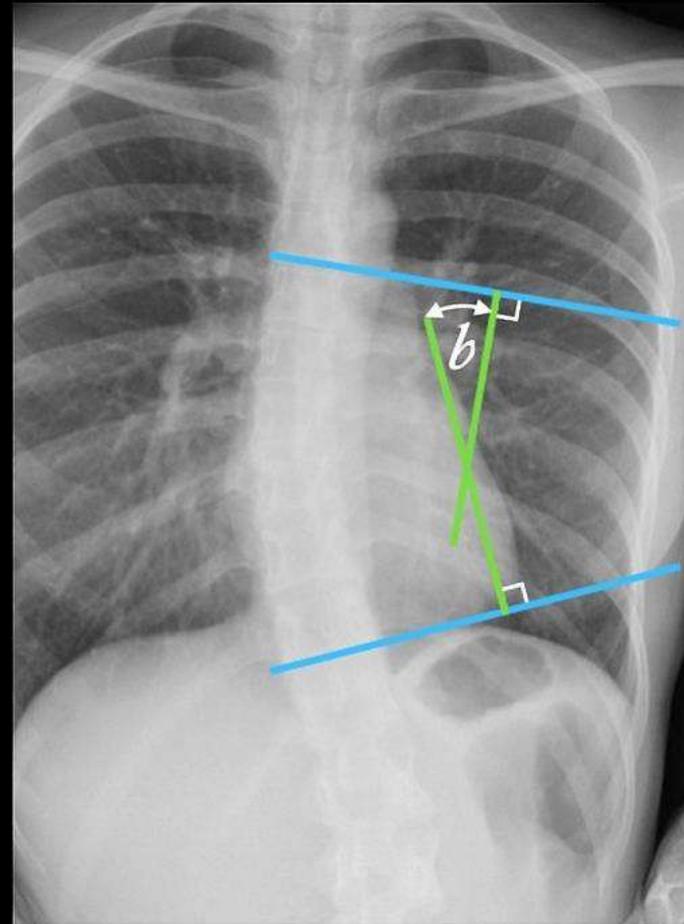
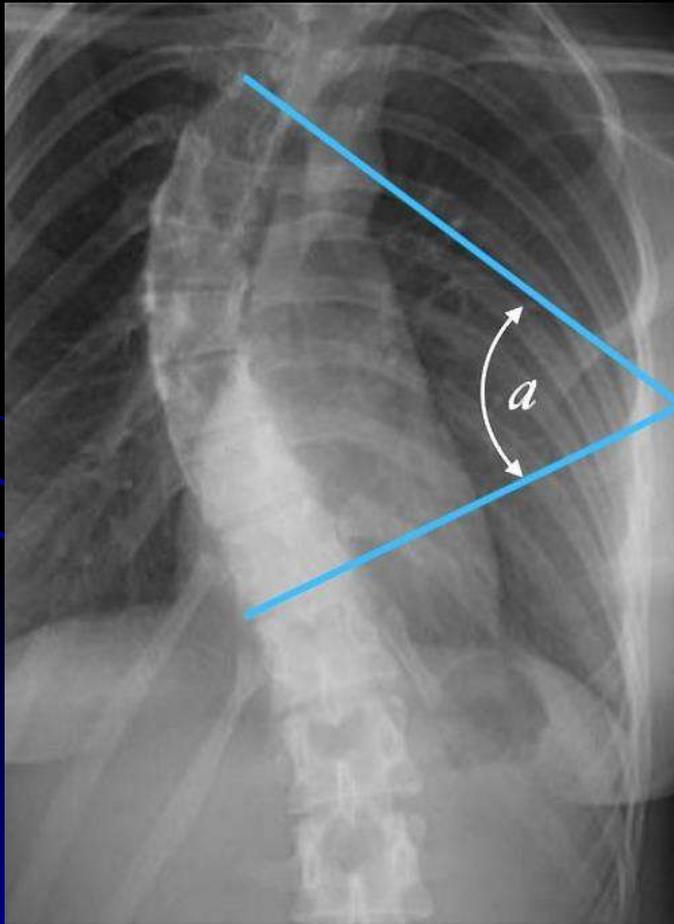
- Alignment
 - Bone
 - Cartilage
 - Soft tissue
- 

Alignment-ABC's

- Posture
 - Convexities
 - Scoliosis
 - If 10-15 years of age, curve less than 20 degrees maybe monitored, assess for progression of 5 degrees or more in a 3 month timeframe.
 - Curves 20-40 degrees may be surgical
- 

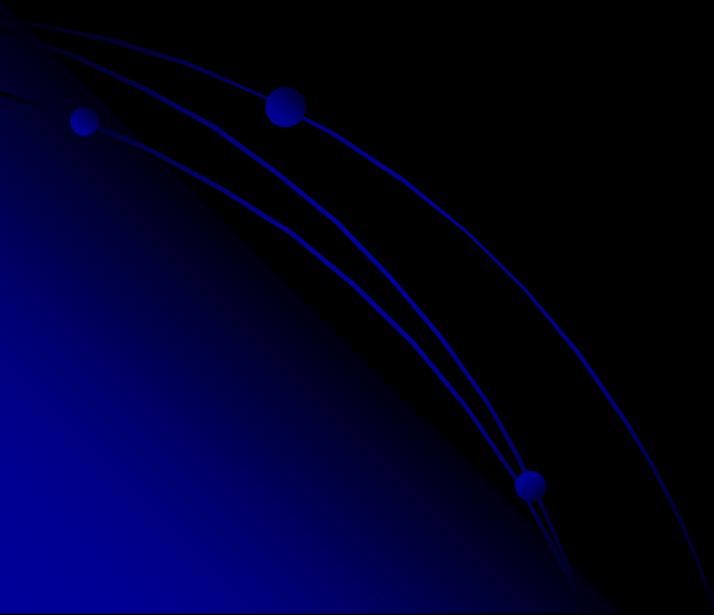
Scoliosis

- Cobb-Lippman method of mensuration



Alignment-continued

- Kyphosis
 - Normal= 20-40 degrees (increases with age)
 - Hypokyphosis: less than 20 degrees
 - Hyperkyphosis: more than 40 degrees



Bone- ABC's

- Shape and size of vertebral bodies
 - Compression deformity=fracture or normal morphology
- Intervertebral foramina
 - Equal in size
 - Stenosis: degenerative posterior osteophyte, degenerative disc disease, facet degeneration, and/or degenerative retrolisthesis.
- Pedicles
 - Missing pedicle= aggressive pathology such as tumor or metastatic disease

Bone-continued

- Spinous processes
 - Make sure they are present, normal cortices, normal size
- Intervertebral foramina
 - Make sure they are clear and equal size
 - Stenosis= posterior osteophyte, degenerative disc disease, degenerative retrolisthesis, facet degeneration

Cartilage-ABC's

- Disc spacing
 - Degenerative disc disease= disc narrowing with or without spondylophytes
- Facet joints
 - Hypertrophied and sclerosis= degenerative joint disease
- Normal costochondral cartilage calcification of the lower ribs

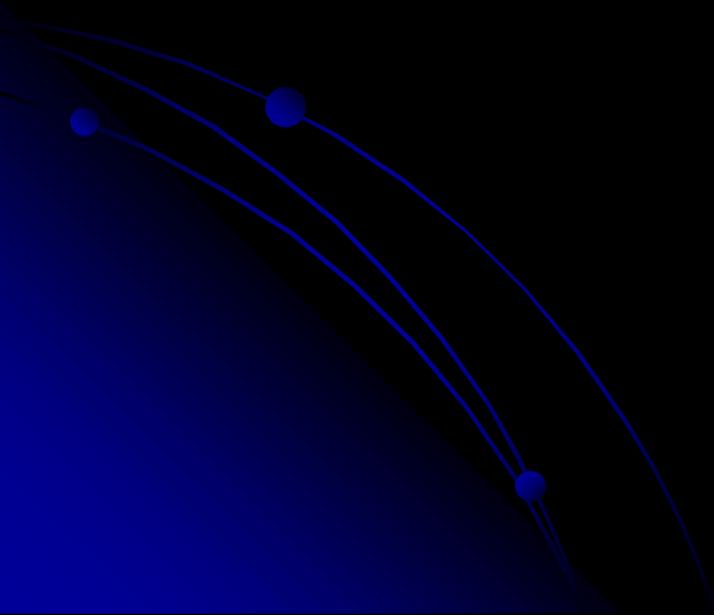
Soft tissues- ABC's

- Chest
 - Lung fields: check for radiopacities/nodules/tumors
 - Tracheal air shadow
 - No deviation; should be midline
 - Aortic knob
 - Atherosclerosis-age related
 - Normal in size

Soft tissue- continued

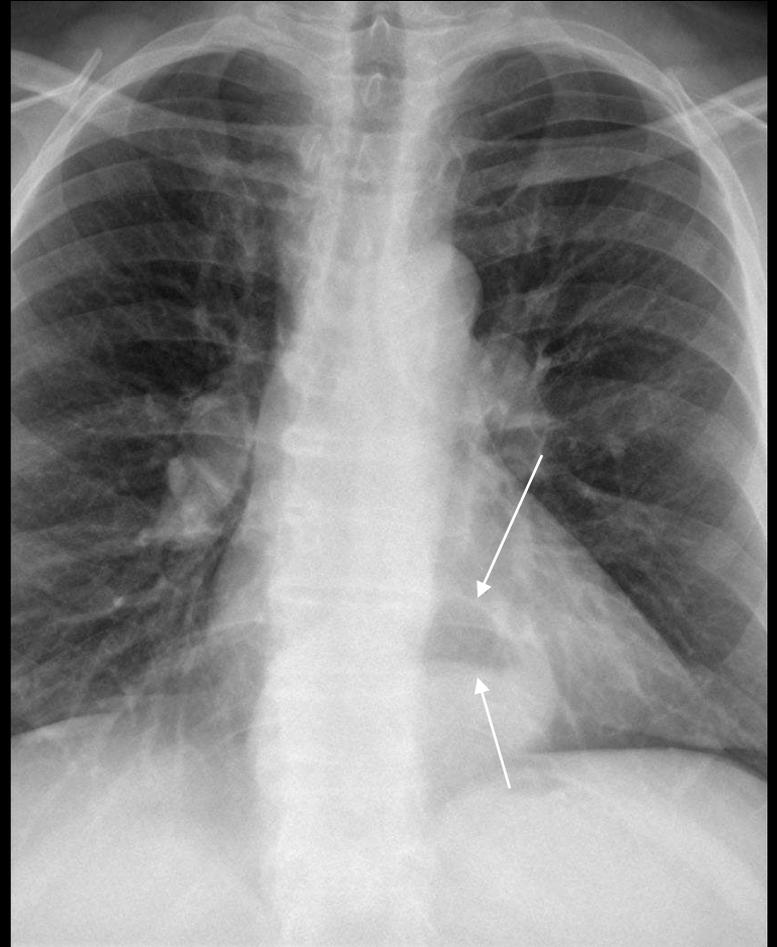
Hemidiaphragm

- Megeblase should not be superior to the left hemidiaphragm= Hiatal hernia



Hiatal Hernia

- Air above the left hemidiaphragm



2-3 Views of the Lumbar Spine

- AP
- Lateral
- Angulated PA or AP lumbosacral spot view
or
- Lateral lumbosacral spot view

AP Lumbar Spine

- **FFD** 40"
- **CR** 1" above iliac crest
- **Collimate** 10 x17



Lateral Lumbar View

- **FFD** 40"
- **CR** 1" above iliac crest
- **Collimate** 11x17



AP and Lateral Views



AP Angulated Lumbosacral

- FFD 40"-5"
- CR 1" below ASIS
- Tube tilt 25-35 °
- *cephalad* (25 degrees caudad for PA angulation)
- Collimate 10x12



AP (PA) Angulated Lumbosacral



Structures Visualized

- L5-S1 Disc Space
- Sacroiliac (SI) Joints: **Best radiograph to evaluate for the SI joints**
- Sacrum Sacral Foramen
- L5 TP's and SP's
- L5 Vertebral Body

(Left) Posterior Oblique View

- FFD 40"
- CR 1" above iliac crest
- Collimate 11x14

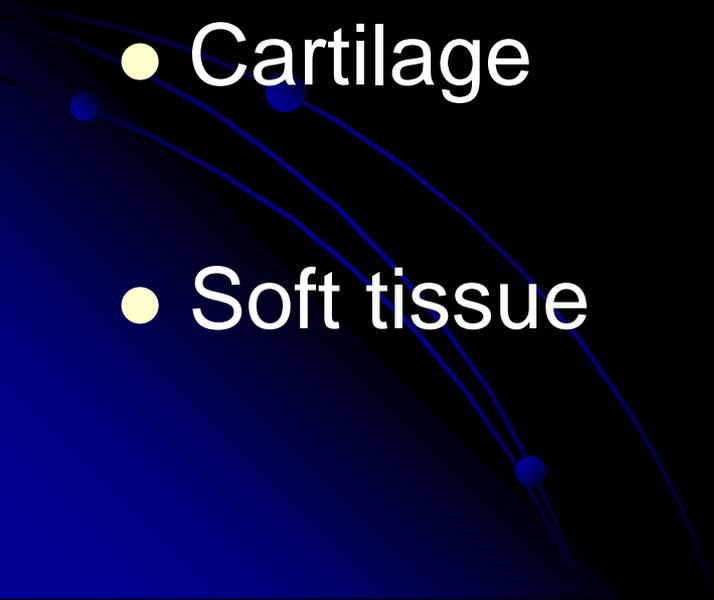


Scotty Dog

- Nose = Transverse process
- Eye = Pedicle
- Ear = Superior facet
- Front leg = Inferior
- Collar thru the neck = Fracture



Evaluation: ABC'S

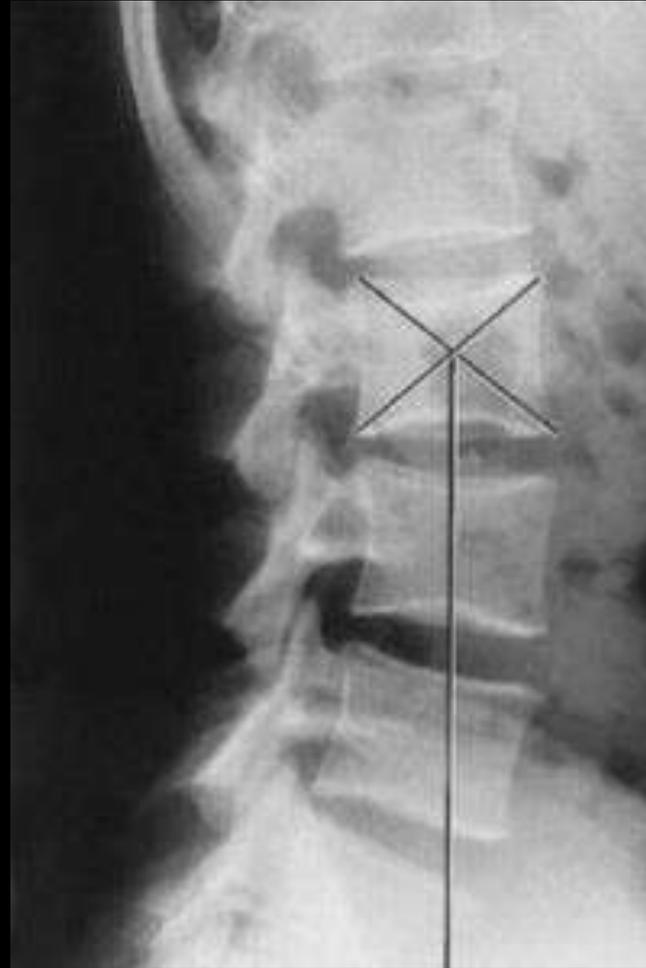
- Alignment
 - Bone
 - Cartilage
 - Soft tissue
- 

Alignment-ABC's

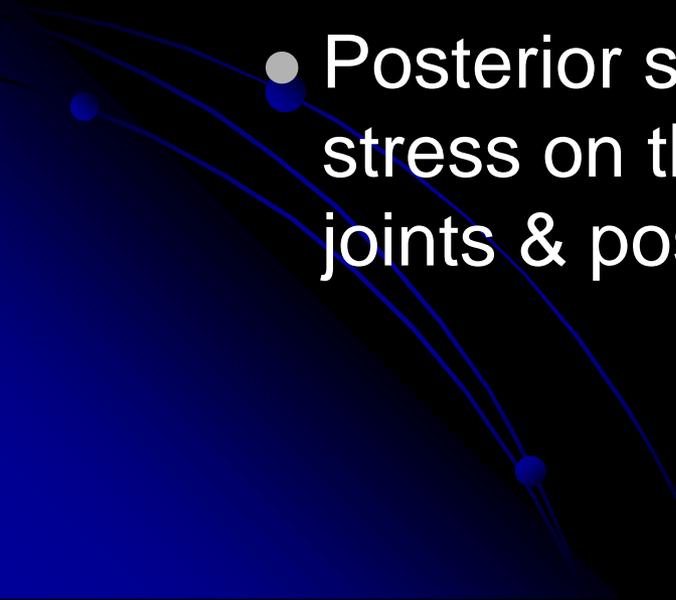
- Anterior and posterior vertebral body line (lateral radiograph)
 - Evaluate for anterolisthesis/retrolisthesis of the lumbar segment, compare to the level below.
 - Cause of anterolisthesis= degenerative changes or pars interarticularis defect or fracture
 - Cause of retrolisthesis= most commonly degenerative changes
- Posture
 - Gravity Line
 - Anterior shift in weightbearing
 - Posterior shift in weightbearing

Evaluation

- Ferguson Gravity Line: from center of L3, should intersect anterior 1/3 of sacrum



Evaluation

- Ferguson Gravity Line
 - Anterior shift in weightbearing= increased stress on facet joints
 - Posterior shift in weightbearing= increased stress on the IVF, pars interarticularis, facet joints & posterior disc.
- 

Evaluation

- Normal Lordosis:
50-60 degrees



Alignment- continued

- Lordosis

- Normal lordosis: 50-60 degree
- Hypolordosis: loss of the lumbar lordosis with straightening.
- Hyperlordosis: increased lumbar lordosis

- Scoliosis/convexities

- If 10-15 years of age, curve less than 20 degrees maybe monitored, assess for progression of 5 degrees or more in a 3 month timeframe.
- Curves 20-40 degrees may be surgical

Bone- ABC's

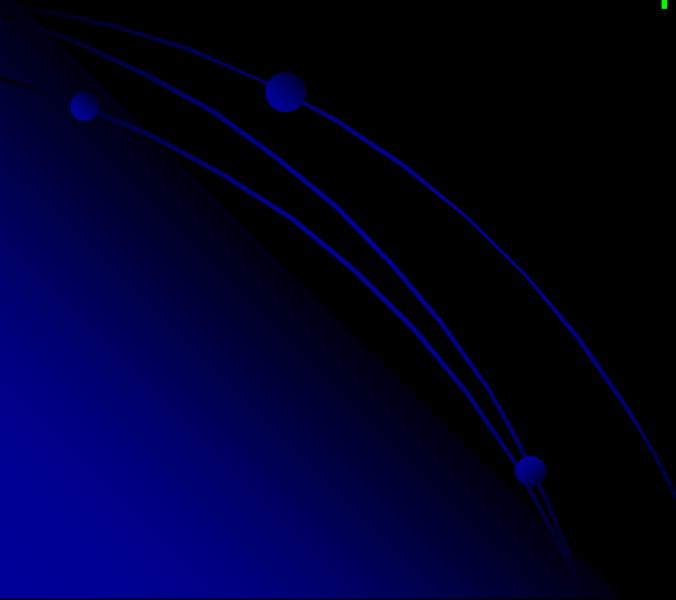
- Shape and size of vertebral bodies
 - Compression deformities
- Pedicles and spinous process
 - Make sure they are present and in the correct location
 - Fractures of pedicles
 - Spina bifida occulta, normal variant.

Normal spina bifida occulta

- No fusion at the junction of the lamina and spinous process
- Posterior cleft



Bone-continued

- Pars interarticularis
 - Defect/fracture
 - Classification of pars interarticularis defects/fractures
 - Grade of spondylolisthesis (anterolisthesis)
- 

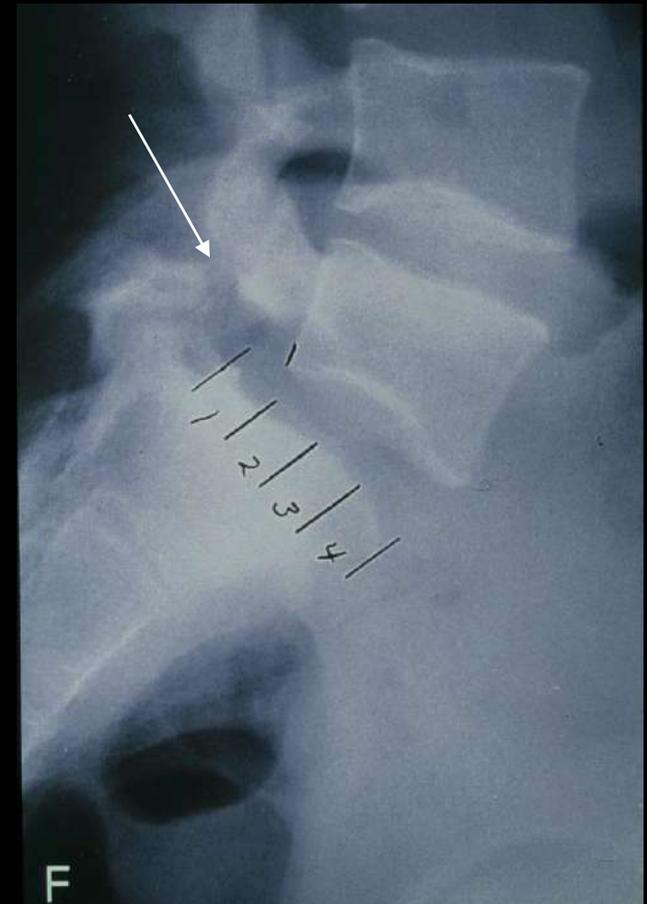
Cause of Anterolisthesis

Types/Causes

- Type 1: Dysplastic (congenital)
- Type 2: Isthmic
 - 2a= fatigue fracture of the pars interarticularis
 - 2b= elongation of the pars
 - 2c= acute fracture of the pars
- Type 3: Degenerative disc disease or degenerative facet joints
- Type 4: Traumatic, fractures to the neural arch
- Type 5: Pathologic, bone disease

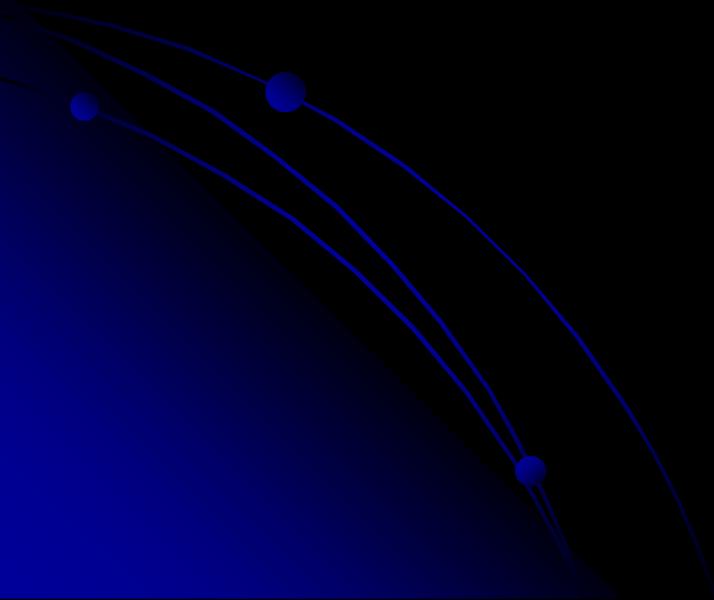
Grade of Spondylolisthesis

- Grade 1 spondylolytic spondylolisthesis at L5
- Meyerding Classification:
 - Grade 1-4

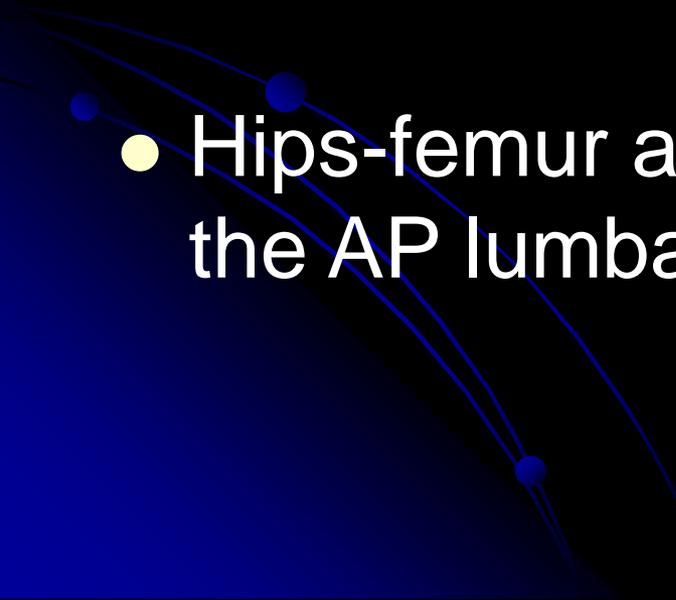


Bone- continued

- Intervertebral foramina
 - Make sure they are clear and equal size
 - Stenosis= posterior osteophyte, degenerative disc disease, degenerative retrolisthesis, and/or facet degeneration.



Bone-continued

- Lower ribs
 - Normal costochondral cartilage calcification
 - Sacrum/Ilium
 - Hips-femur and acetabulum if included in the AP lumbar study
- 

Cartilage-ABC's

- Facet joints
 - Degenerative changes
- Sacroiliac joints
 - Degenerative changes= bony proliferation, sclerosis and joint narrowing.
 - Inflammatory (ankylosing spondylitis)=**bilateral erosive changes, widening of the joint; or complete fusion**

Cartilage-continued

- Transitional segments
 - L5= sacralization
 - S1=lumbarization
 - Classification
- Intervertebral discs
 - Disc spacing= narrowing with/without spondylophytes is degenerative changes.

TRANSITIONAL SEGMENT AT L5



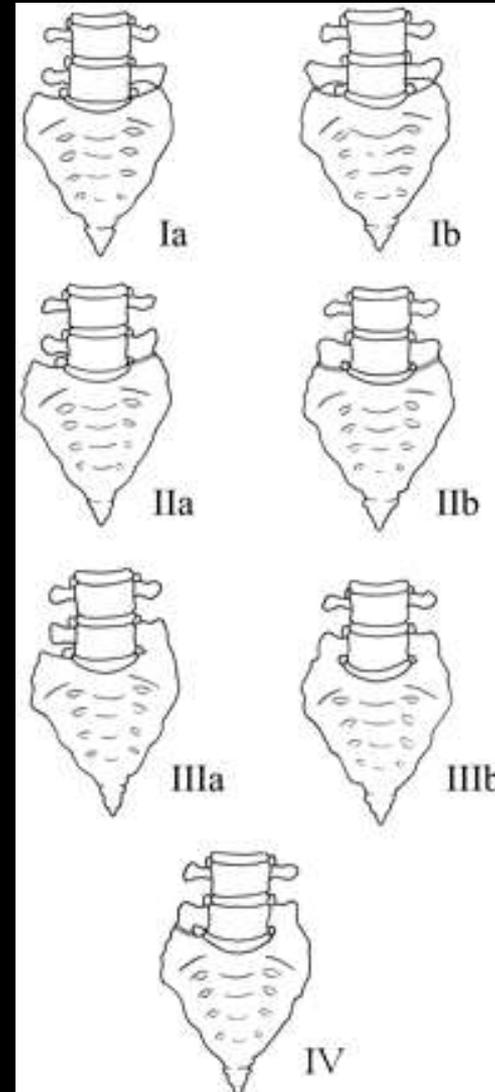
Transitional Segment at L5

- Sacralization of L5
 - Bilateral pseudoarthrosis, articulation to the sacrum,
 - **IIb Castellvi**
- Complication
 - Increased stress above and below
 - **Early degenerative disc disease at L4-L5.**



Castellvi Types

- Type II and IV- associated with low back pain=
Bertolotti's syndrome-
inflamed transitional segment.
- Clinically misdiagnosed as sacroiliitis.

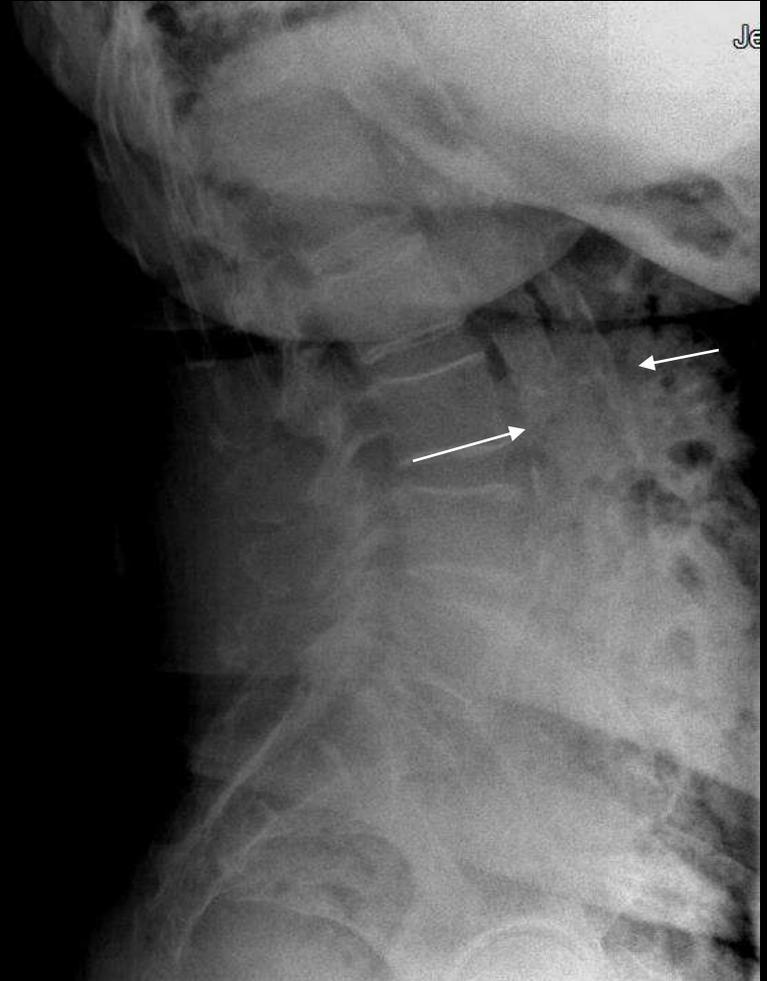


Soft tissues- ABC's

- Anterior soft tissues
 - Atherosclerosis of abdominal aorta, iliac arteries
 - Calcification of abdominal aorta: width of abdominal aorta should not exceed 2.0 cm (lateral radiograph)
 - Gallstones: right upper abdominal quadrant, AND anterior to the spine
 - Kidney stones: right or lower abdominal quadrant, but overlies or adjacent to the spine.
- Lower lung field
 - Check for radiopacities or tumors/masses
- Bowel gas

Atherosclerosis of abdominal aorta

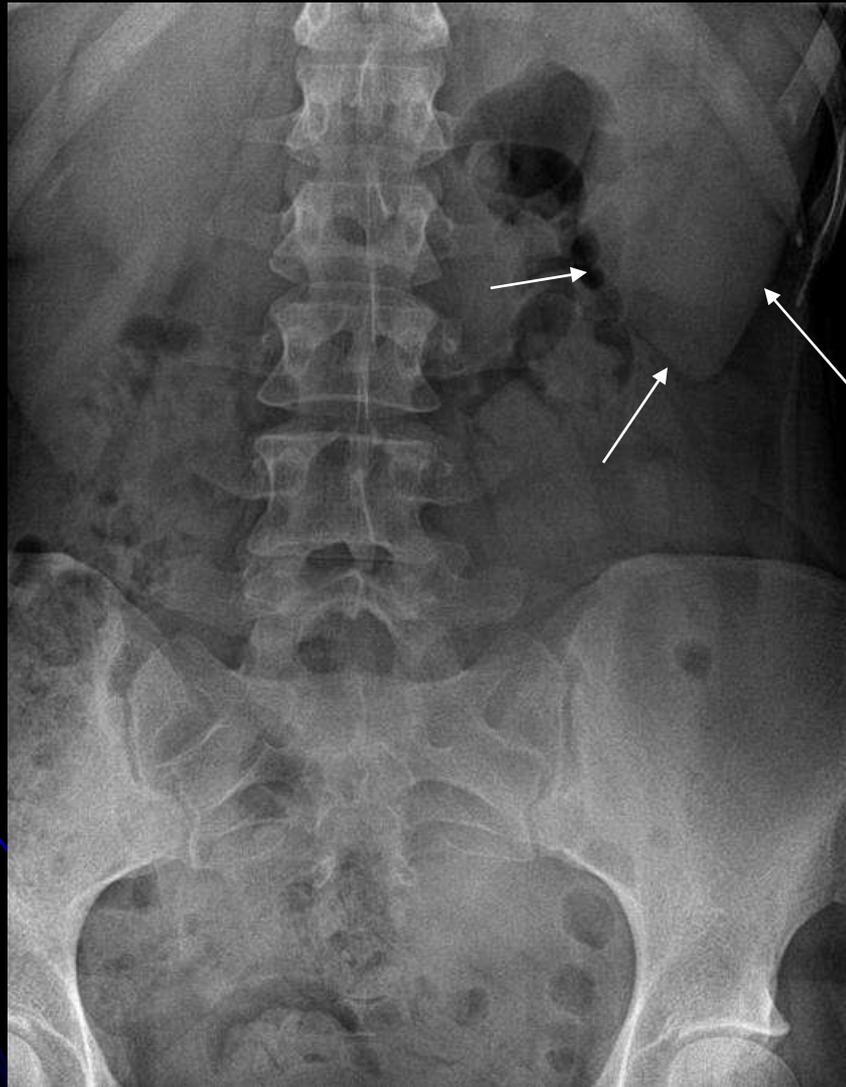
- Widening of abdominal aorta, greater than 4.5 cm



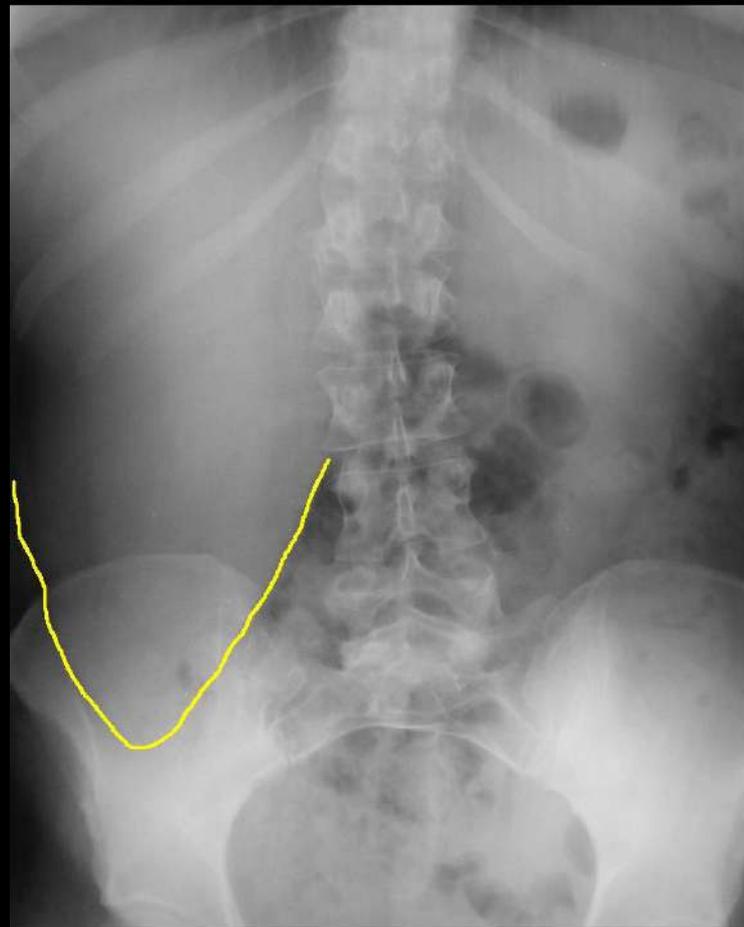
Soft tissues-continued

- Organ shadows
 - Kidney: calcifications/stones
 - Liver: Enlarged (hepatomegaly)
 - Spleen: Enlarged (splenomegaly); extending inferiorly from the left 12th rib.
- Pelvic basin
 - Bladder shadow: Distended= prostate pathology
 - Uterine fibroids (benign calcifications)
 - Vas deferens calcification= V-shaped tubular calcification within the mid portion of pelvic basin
 - Associated with diabetes

Splenomegaly



Hepatomegaly



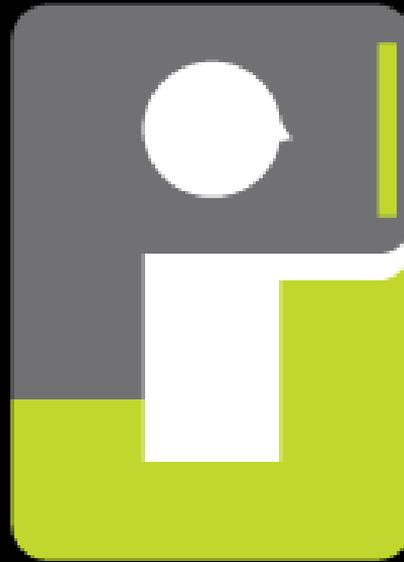
Vas Deferens Calcification



Soft tissues-continued

- Surgical artifact within the abdomen and pelvic basin
 - Cholecystectomy (gallbladder removal)
 - Vascular clips
 - Intrauterine device
- 

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INTERPRETATION

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marcusstrutzdc@gmail.com

[707.972.0047](tel:707.972.0047)

