

X-Rays:

— The Good,

The Bad,

& The Ugly

Learning Objectives

- Key landmarks and anatomy
 - Thoracic technique
 - Abdominal technique
- Need for orthogonal views
- Collimation vs. cropping
- Tips and tricks for best results
- Checklists and self-critique
- Special circumstances
- Assessment challenges
- Sneak peek at 2024 radiography CE



Landmarks

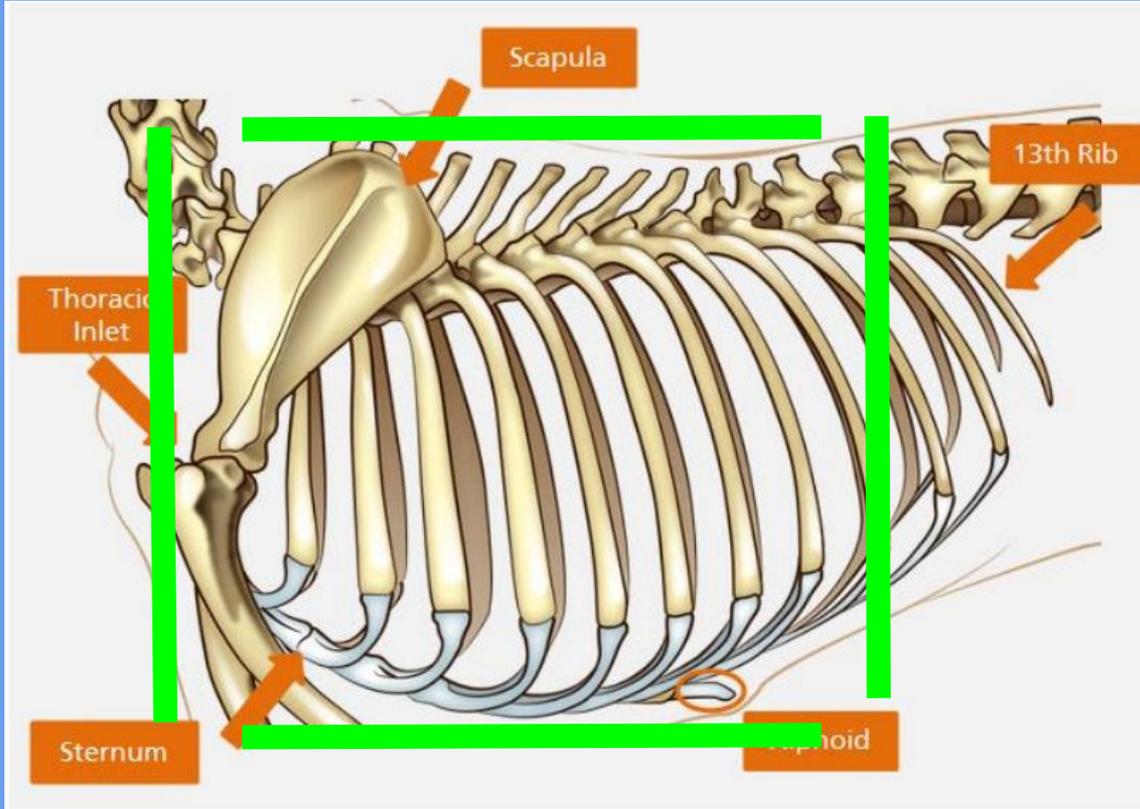


Thoracic Landmarks

Center = heart

Cranial:
Manubrium
(top of sternum)

Caudal:
Between 13th
rib and xiphoid
(bottom of
sternum)



Dorsal:
Include skin
and spinous
processes

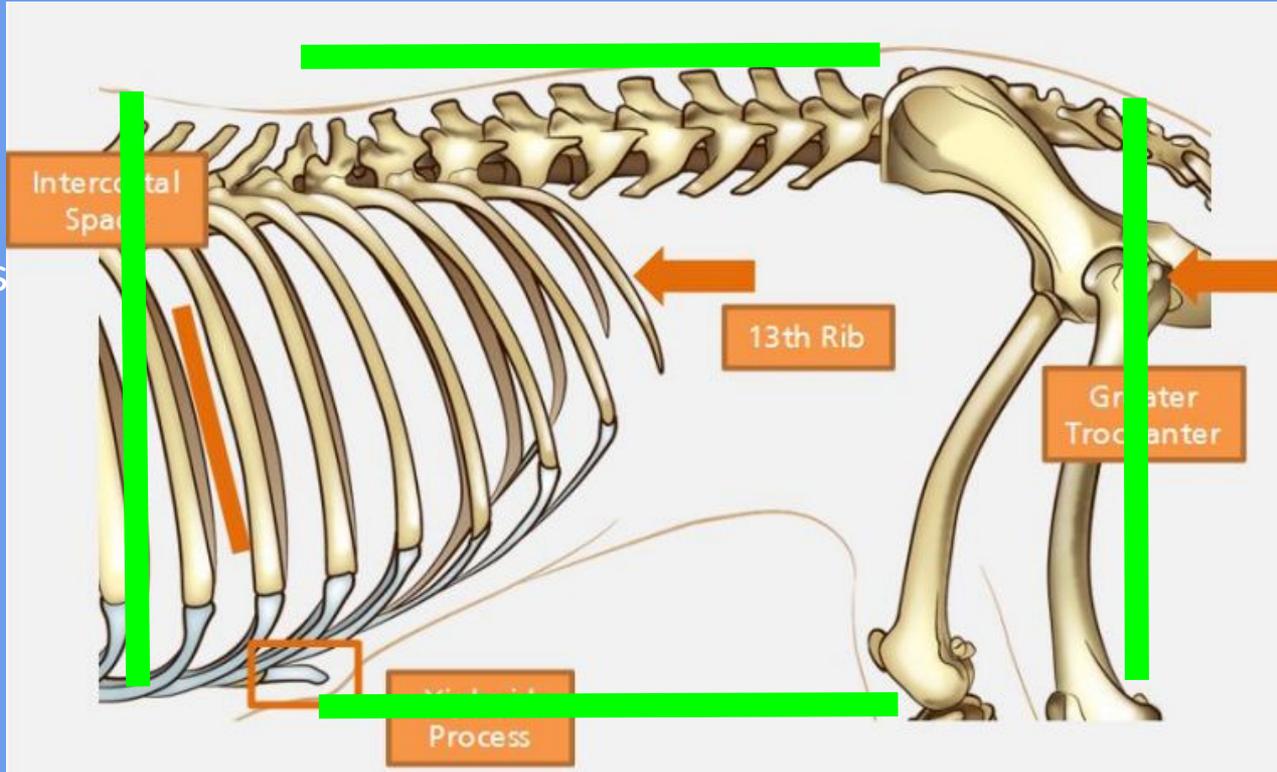
Ventral:
Include
sternum and
skin

Abdominal Landmarks

Center =
13th rib

Cranial:
3 rib spaces
cranial to
xiphoid

Caudal:
Greater
trochanter of
femur



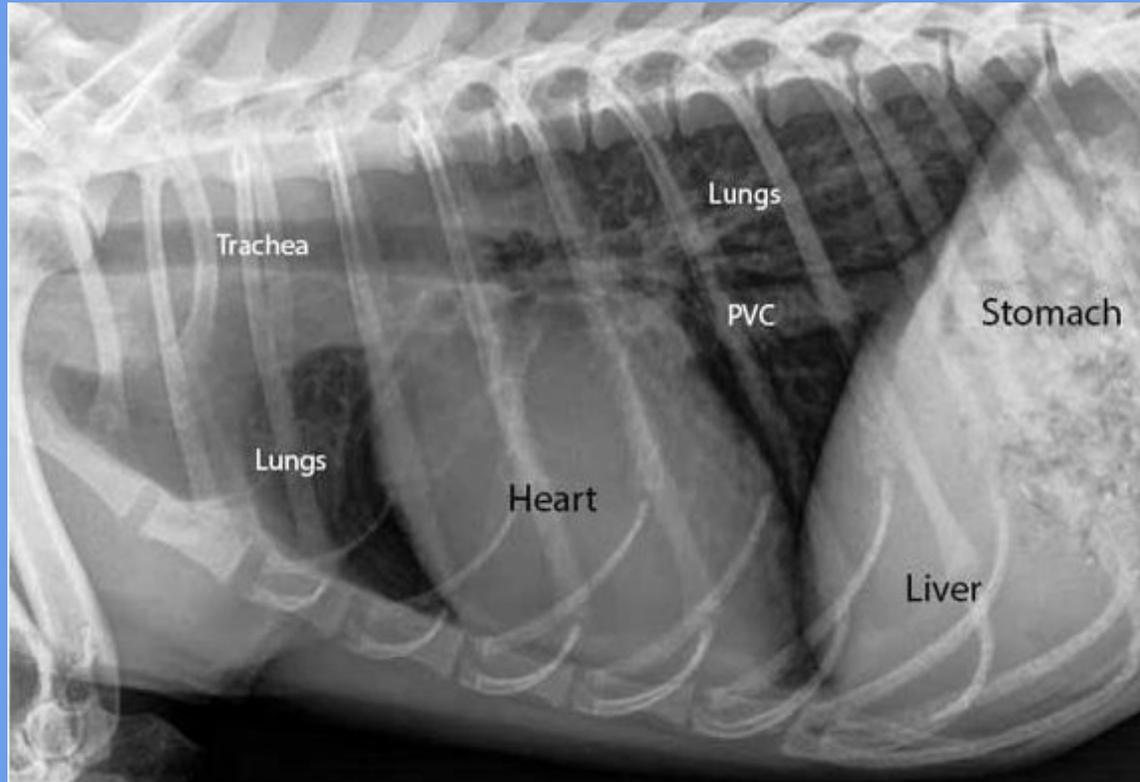
Dorsal:
Include skin
and spinous
processes

Ventral:
Include
sternum and
skin

— Thoracic Anatomy



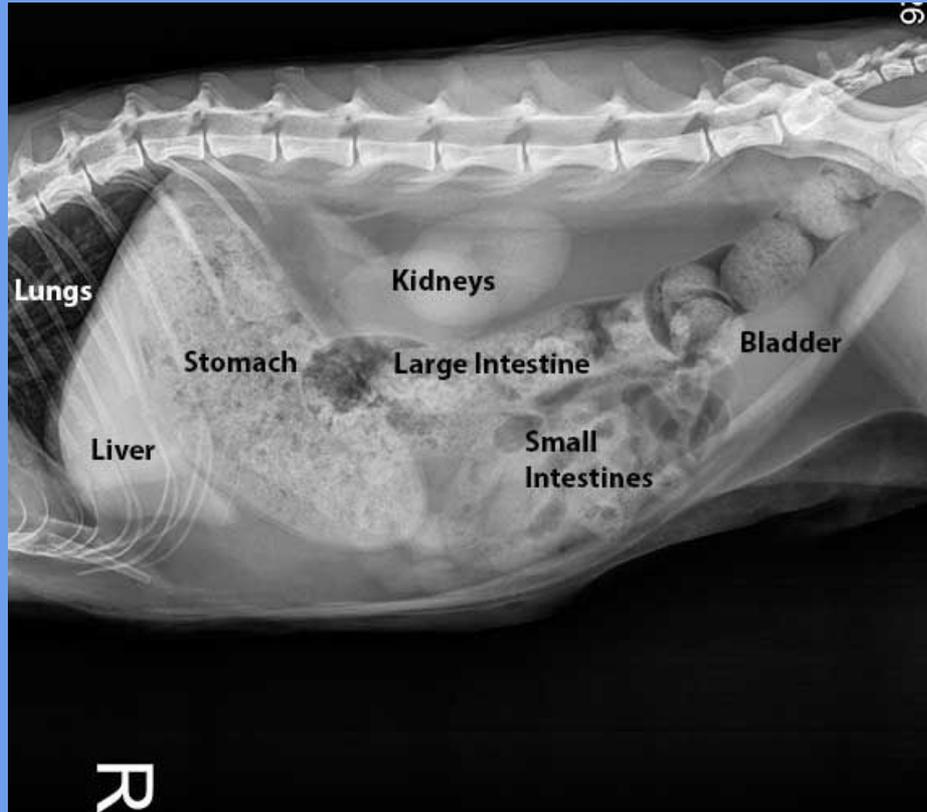
Internal Thoracic Structures



— Abdominal Anatomy



Internal Abdominal Structures



Orthogonal Views

Ugh! Why are we doing two or three views?

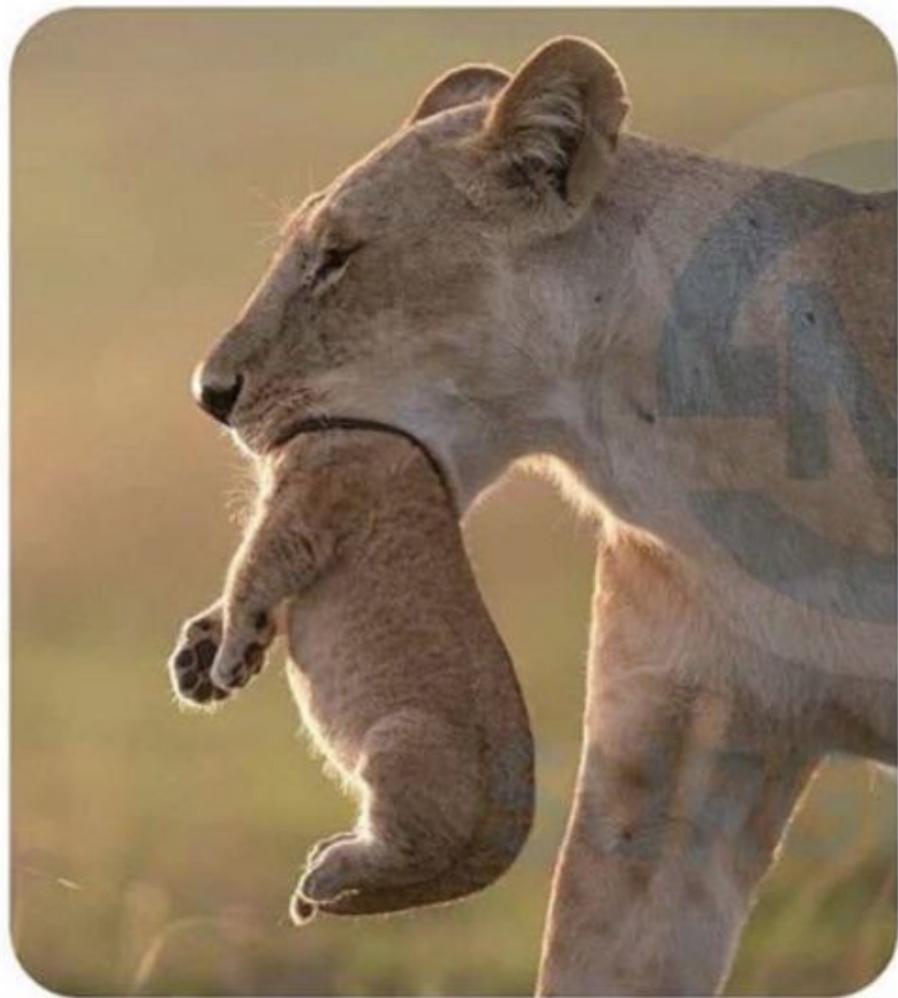
- Radiographs = a 2D representation of a 3D subject
- Orthogonal views (at right angles to each other) are essential to clearly see the location of anatomy in space



Because otherwise...

... you're only getting part of the information!

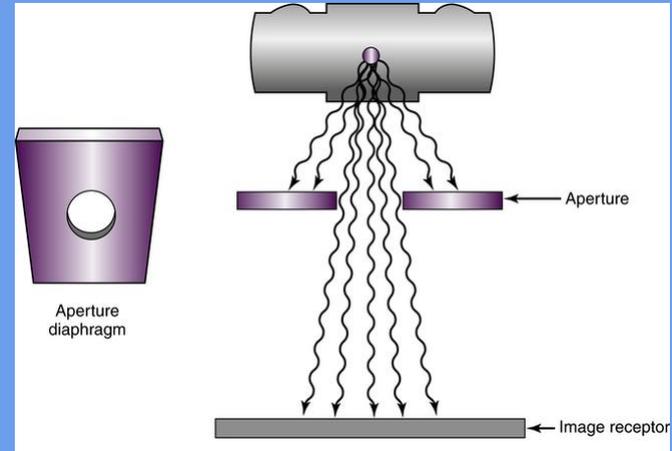
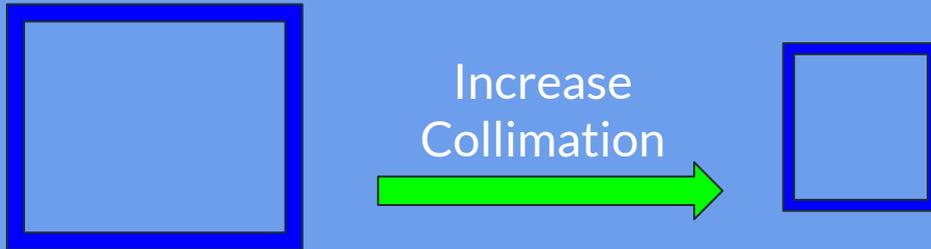




Collimation vs. Cropping

Collimation – What is it and why do it?

- **Collimation** is adjusting the field/size of the X-ray beam to fit the anatomy you are imaging.
 - More collimation = smaller field/beam
- Collimation
 - Reduces scatter radiation
 - Reduces radiation exposure/dose to patient AND staff
 - Improves image contrast
 - Improves image quality



Cropping - Doesn't Improve Quality

- **Cropping** an image after taking a radiograph
 - Simply removes unwanted space
- Since greater amount of scatter radiation still occurred from large field:
 - “Damage” is already done
 - Larger, unnecessary radiation exposure to patient and staff
 - Poorer image contrast
 - Due to film fog of bouncing scatter
 - Overall darker image
 - Poorer image quality

Tips & Tricks for an Instagram-worthy rad!

Picture-Perfect Tips

1 | Walk Dogs Before Radiographs

- Empty that bladder!
- Better visualization of internal organs now that there is more room in the abdomen

2 | Clean & Dry Haircoat

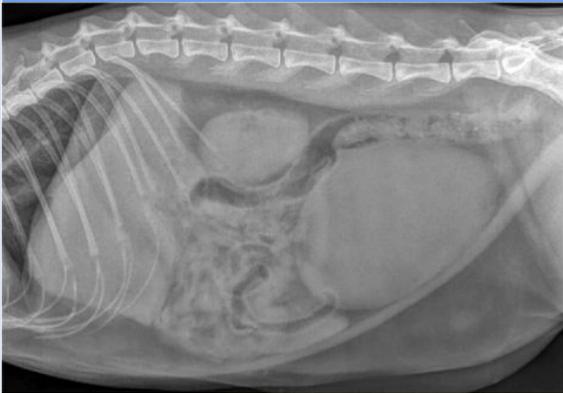
- Crud in fur can appear as artifact in image
- Wet fur mimics effusions/fluid in the patient

3 | Spoon Technique

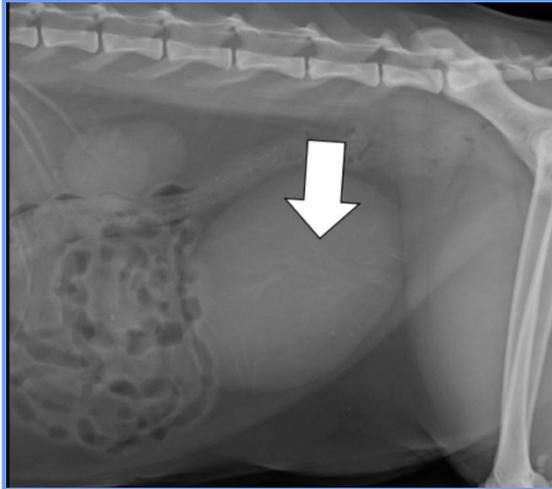
- Wooden spoon - gently compress abdomen
- Smushes intestines out of the way - can see bladder/stones/intestinal FBs clearly
- Radiation passes through wood

Picture-Perfect Tips

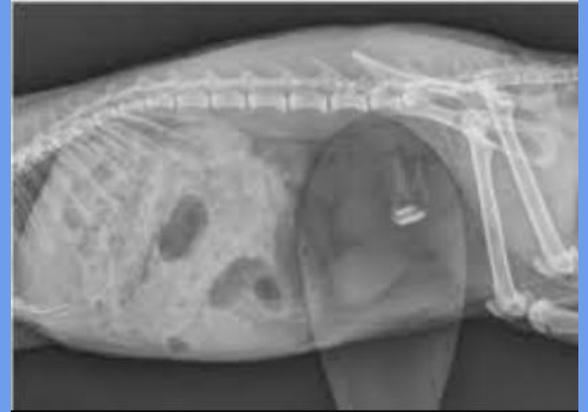
1 | Walk Dogs Before Radiographs



2 | Clean & Dry Haircoat



3 | Spoon
Compression
Technique



Full vs. Empty Bladder





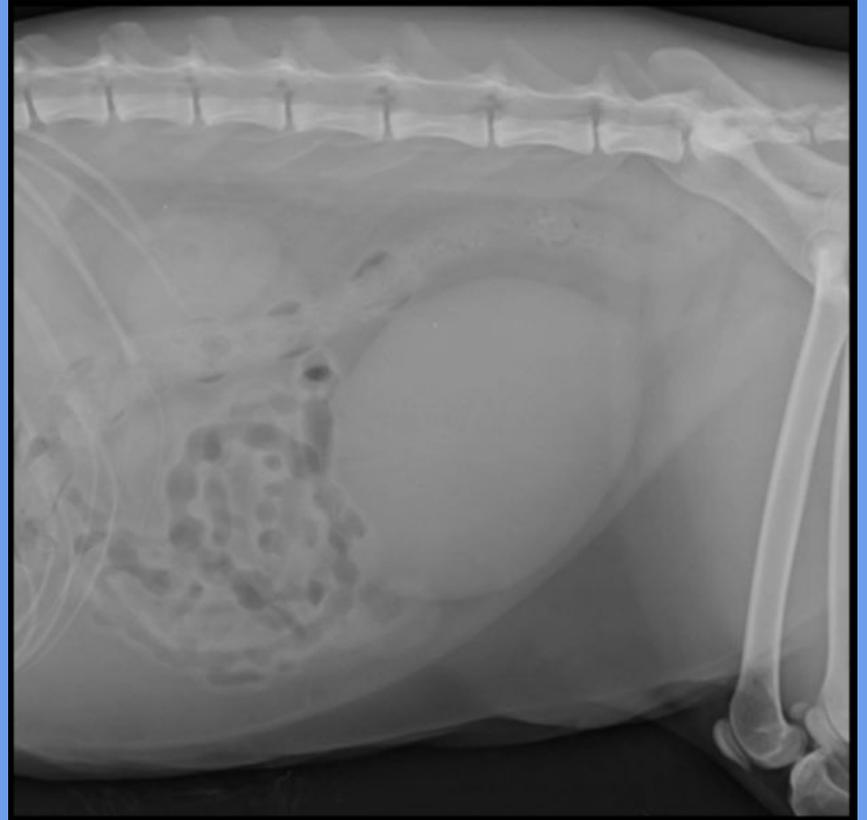
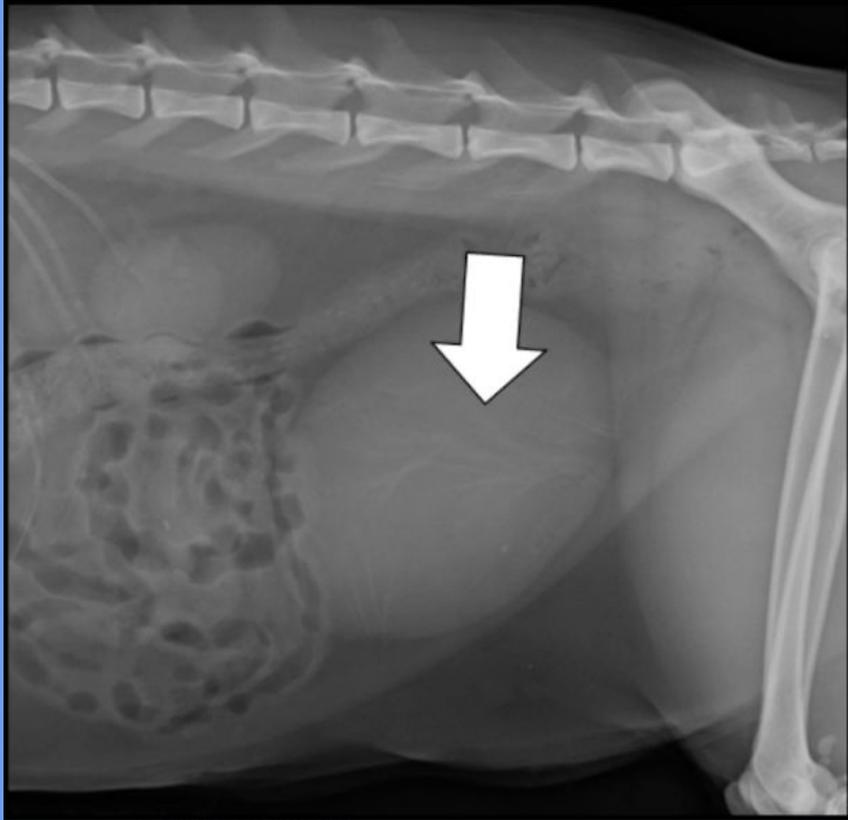
Full
vs.
Empty
Bladder



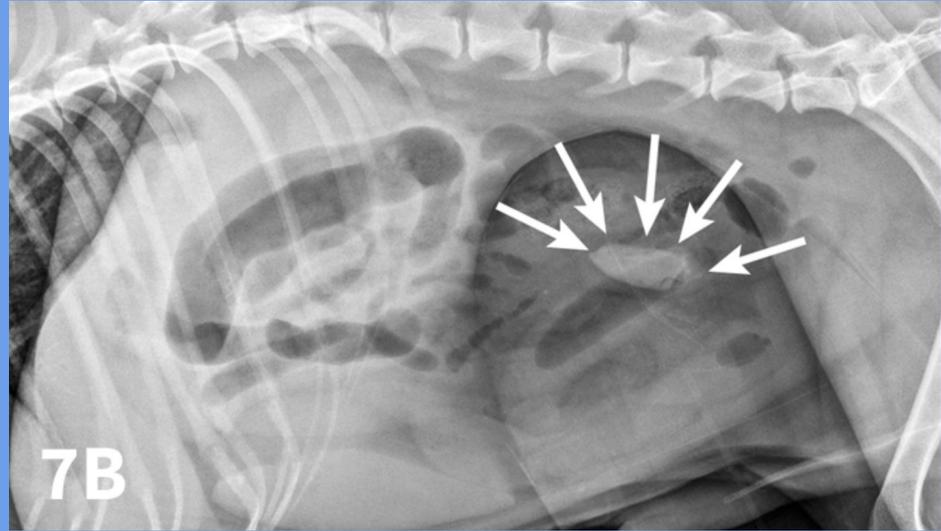
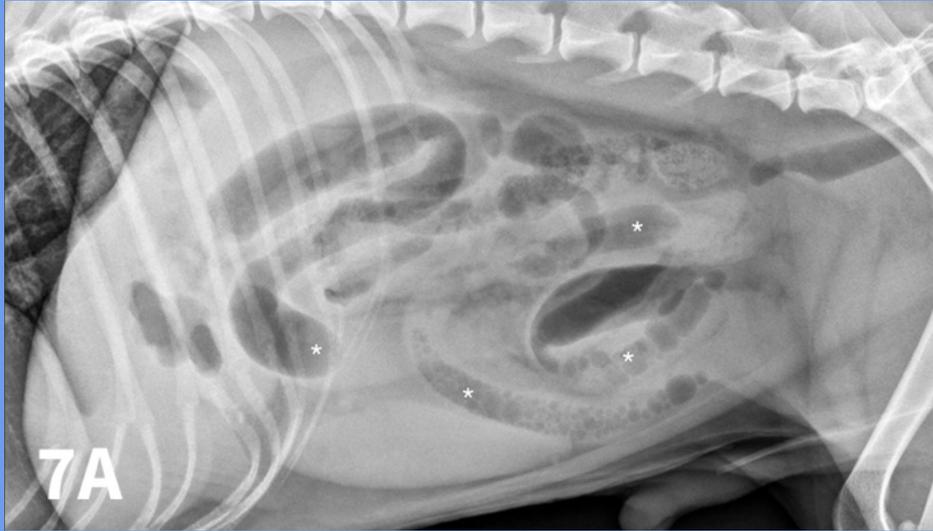
Wet Fur Artifact



Wet Fur Artifact vs. Dry Patient



Compression Radiography



Picture-Perfect Tips

4 | Thoracic Timing - Inspiration

- Capture rad when patient breathes IN
- Expands lungs, make thoracic cavity large and easier to visualize anatomy

5 | Abdominal Timing- Expiration

- Capture rad when patient breathes OUT
- Diaphragm moves cranially as lungs deflate
- Abdominal cavity is enlarged, making it easier to visualize anatomy

6 | Single Plane - Avoid Rotation

- Patient should be parallel to table
- Patient should be in one plane in space
- Use foam wedges to avoid thoracic rotation of deep/keel chested dogs, pelvic rotation

Picture-Perfect Tips

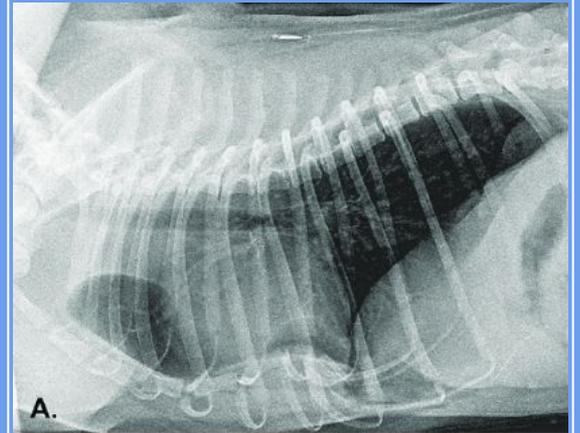
4 | Thoracic Timing - Inspiration



5 | Abdominal Timing - Expiration



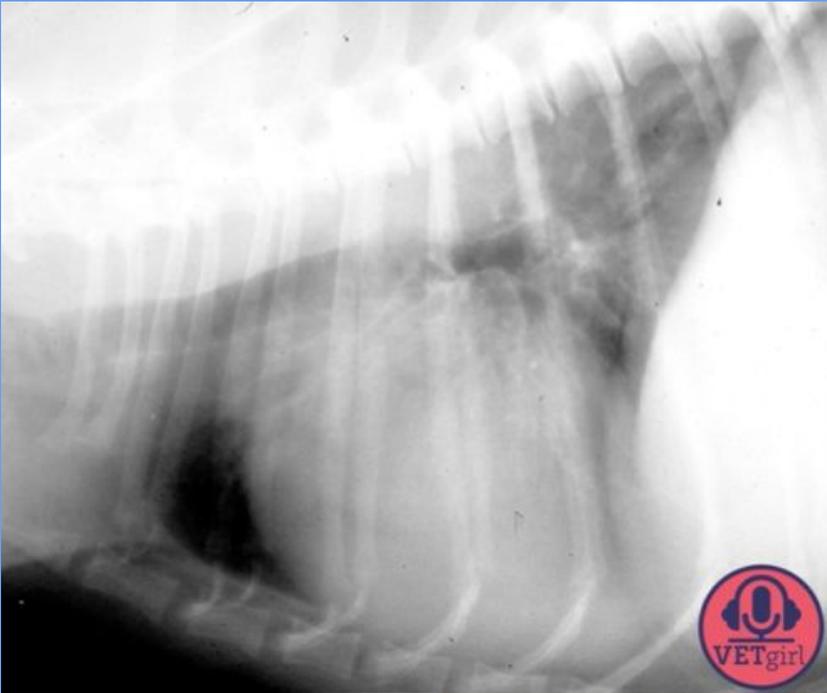
6 | Single Plane - Avoid Rotation



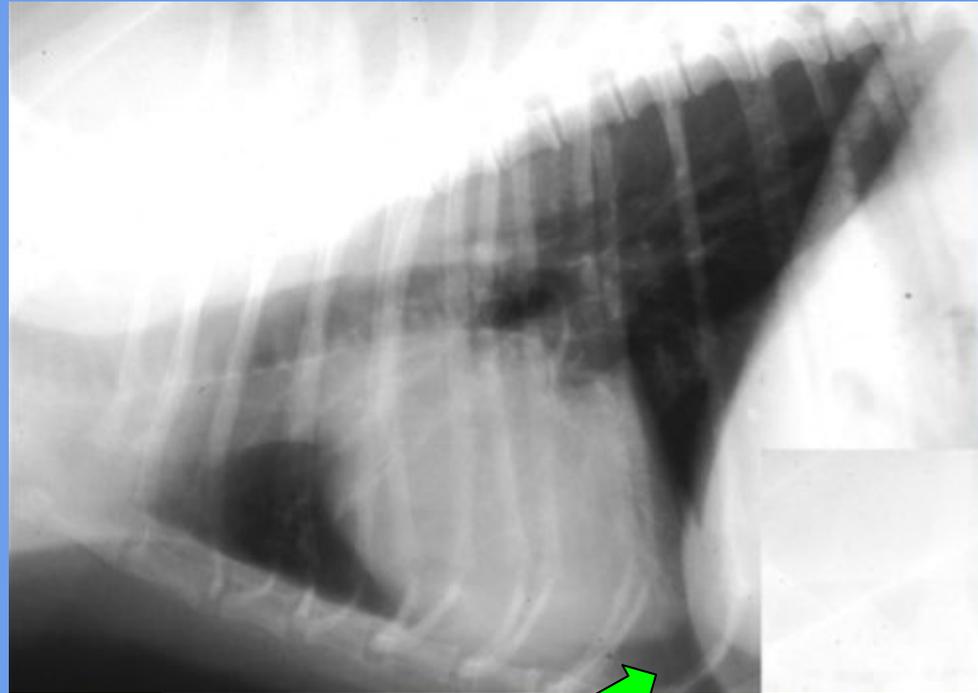
Thoracic Expiration vs. **IN**spiration



Thoracic Expiration vs. **IN**spiration

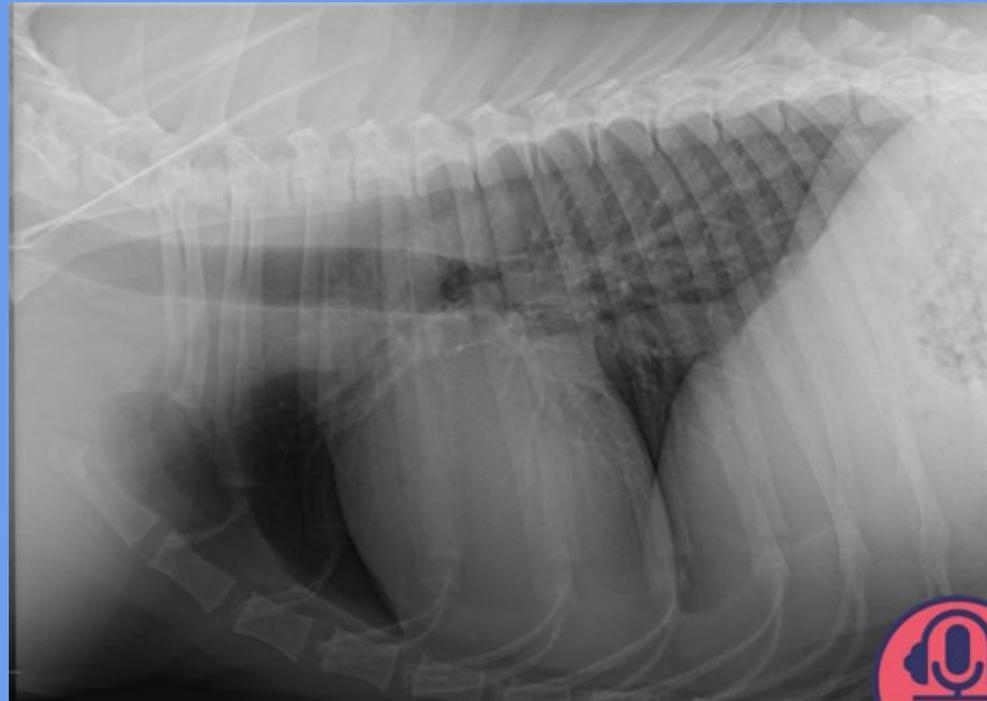
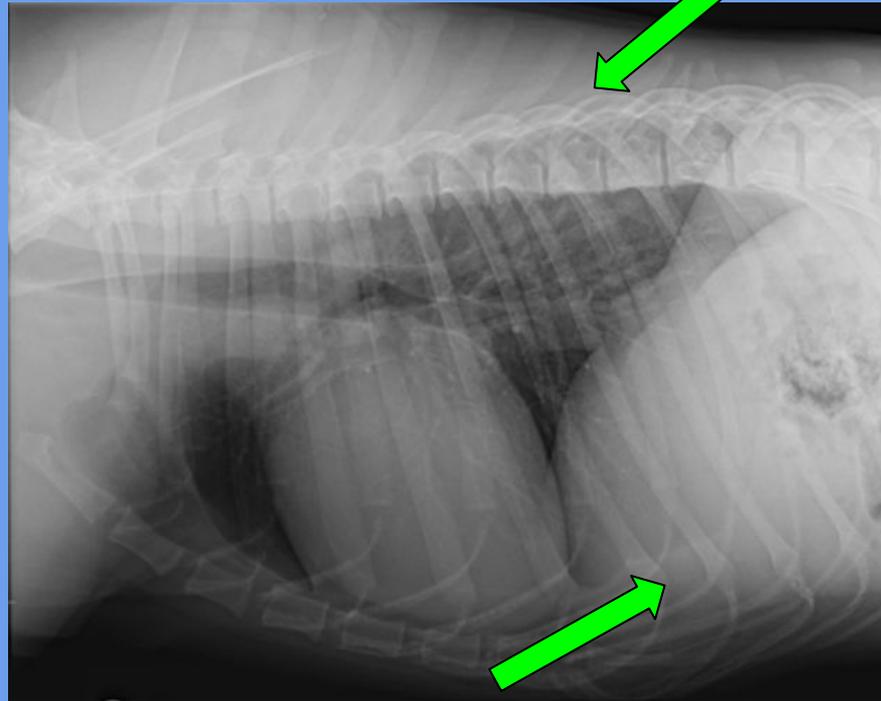


Breathing **OUT**

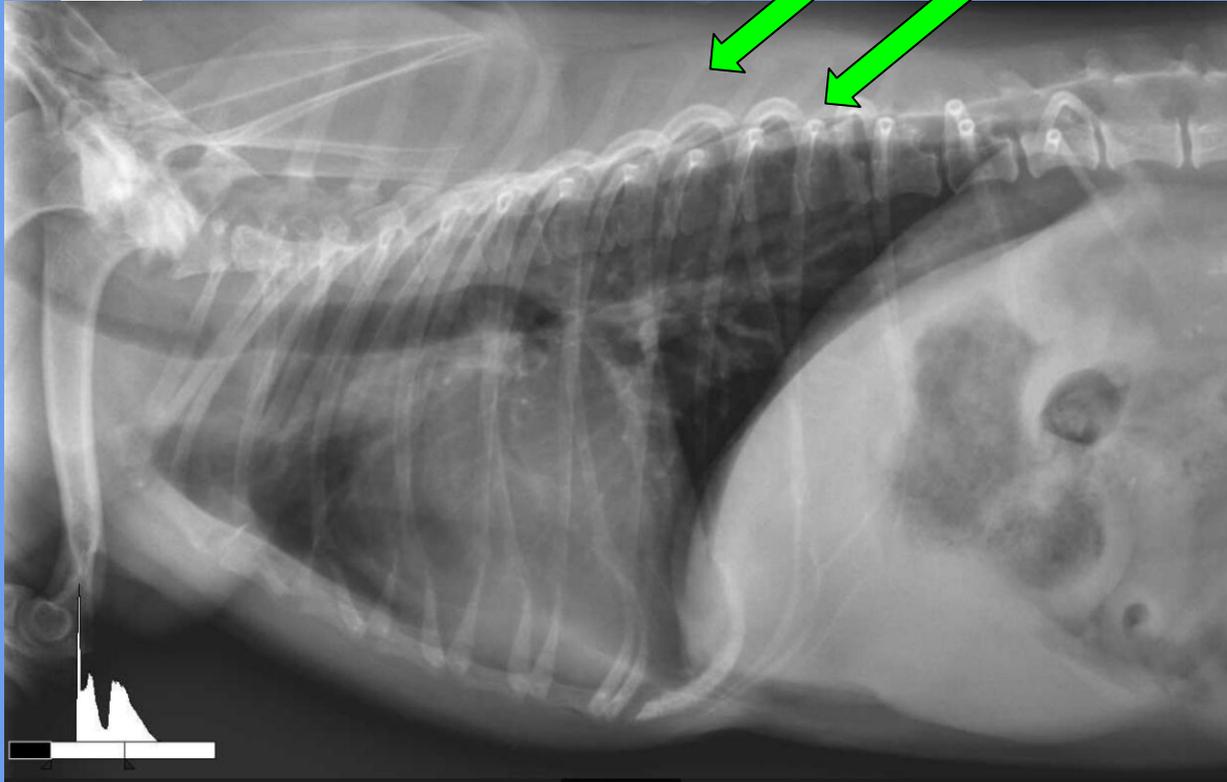


Breathing **IN**

Use Foam Wedges to Prevent Rotation



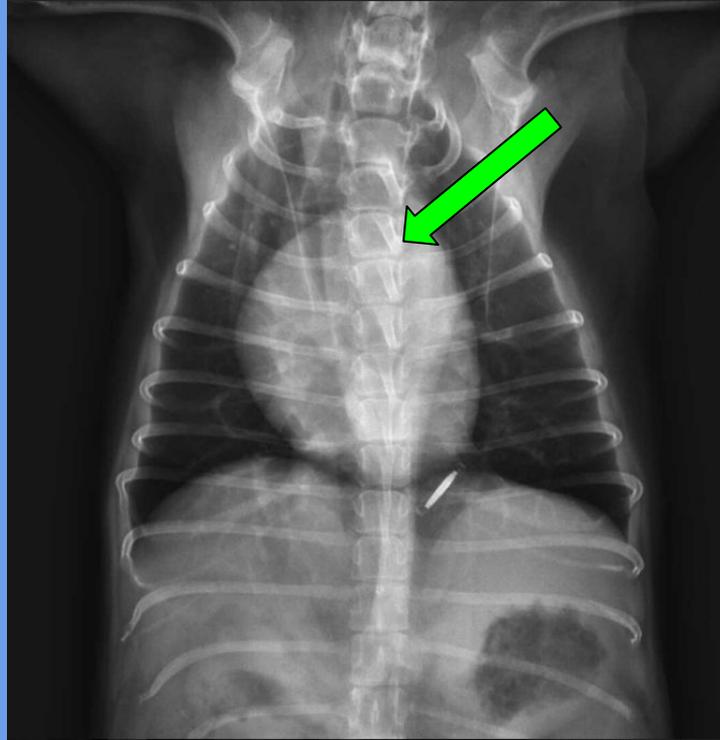
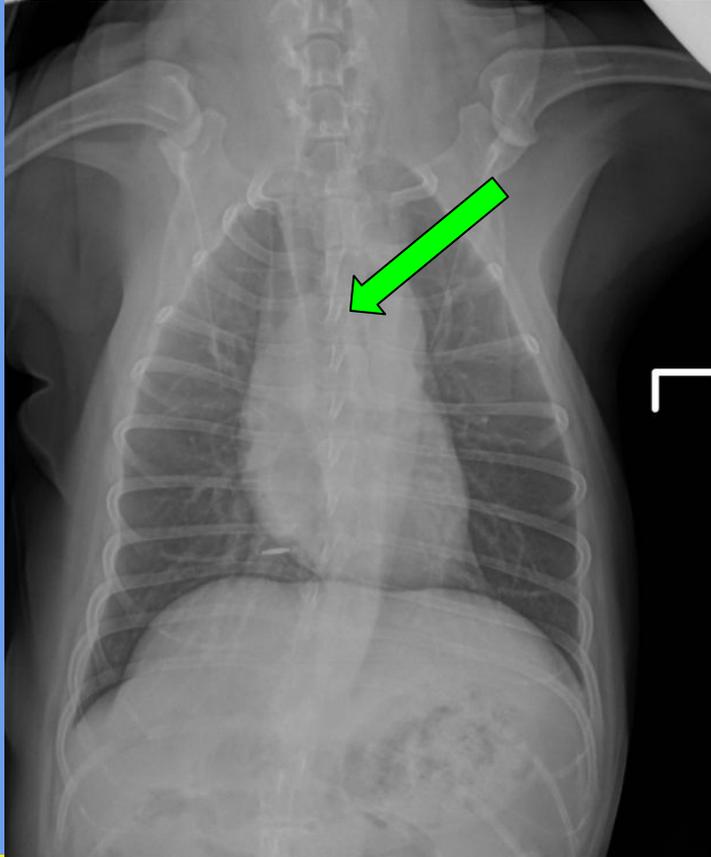
Thoracic Rotation



Ribs should overlap
each other

Spinous processes
should be in line

Thoracic Rotation



Sternum and spine should overlap each other

Spinous processes should be centered in vertebrae

Whole Body Rotation ➤ and Correction



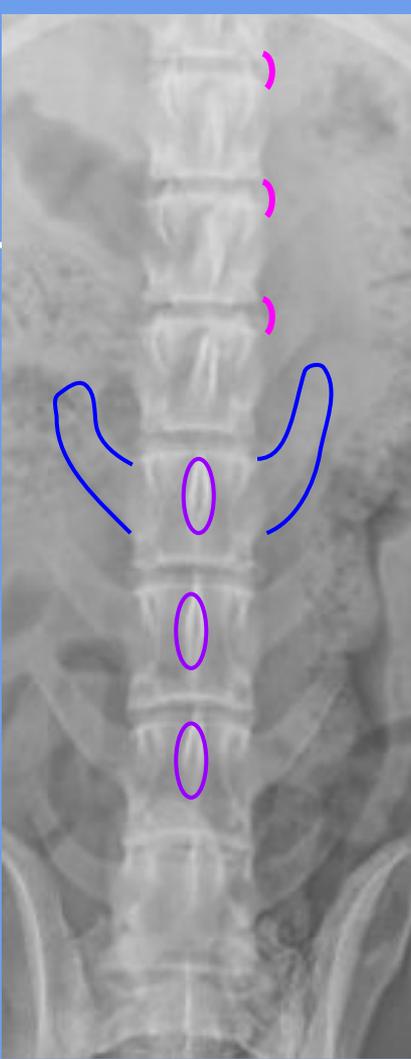
Heart = centered in thoracic cavity

Spine is straight,
intervertebral spaces are even
and consistent,
transverse processes are
symmetrical, and
spinous processes appear as
ovals centered in each vertebrae

Pelvis = symmetrical and femurs
are ~parallel



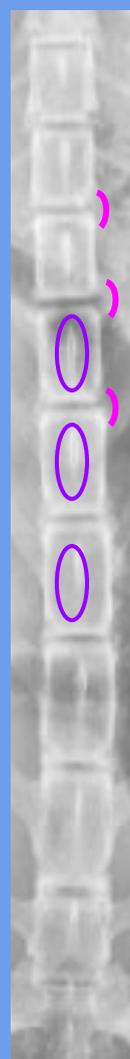
That Sexy Spine



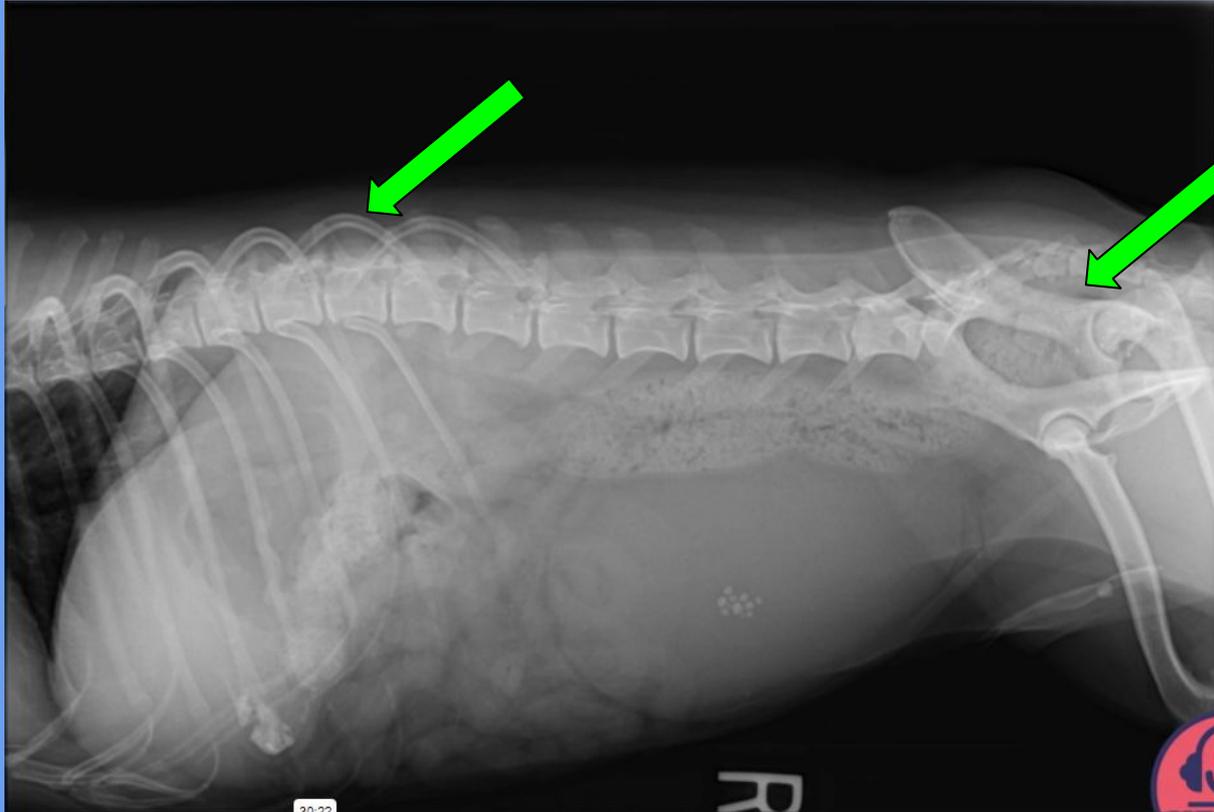
Intervertebral spaces are even and consistent

Transverse processes are symmetrical

Spinous processes appear as ovals centered in each vertebrae

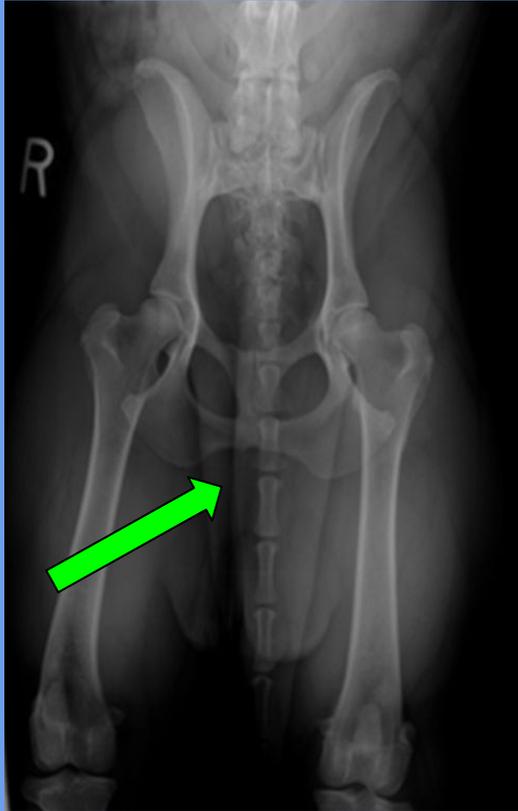


Abdominal Rotation

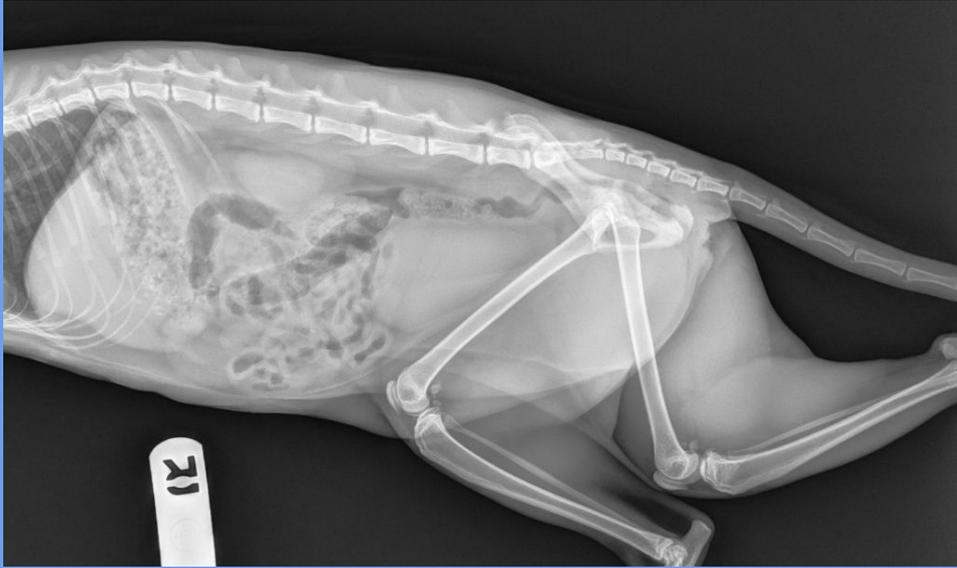


Pelvic halves should overlap each other

Check Symmetry - Prevent Rotation



Limb Extension



Prevent overlap of tricep or thigh muscle/tissue

Considerations for arthritic pets



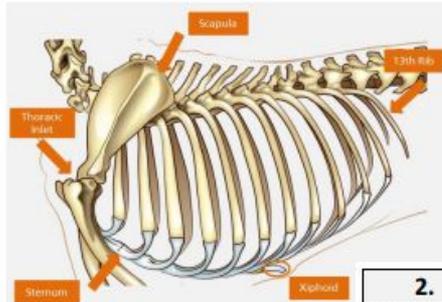
Checklists - Critique That Rad

Thoracic Technique

1. Check the anatomical boundaries

Lateral

Anatomy Boundaries Needed



The area cranial to the thoracic inlet (the manubrium) to half way between the xiphoid process and the last rib to include the caudal tips of the lungs.

The crosshairs of the beam should be centered over the heart just behind the scapula and 1/3 of the way up from the sternum.

2. Is the patient straight? Is the positioning appropriate?

Checklist

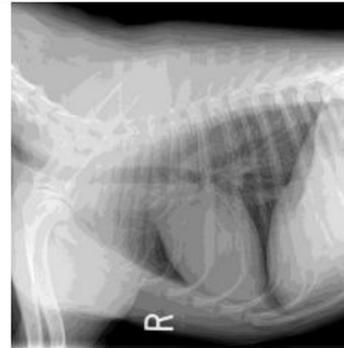
- ✓ Patient right side (affected side) down
- ✓ Extend forelimbs and hindlimbs out of area of collimation
- ✓ Head in neutral position
- ✓ Positioning devices can be used
- ✓ Collimate to landmarks
- ✓ Verify positioning
- ✓ Capture image upon inspiration



3. Is the technique appropriate? Is the background black? Can you see the needed anatomy including soft tissues?

Lateral

Anatomy Needed



- the cardiac silhouette (heart)
- pulmonary vessels
- trachea
- lungs
- diaphragm

- There should be superimposition of the ribs on this view

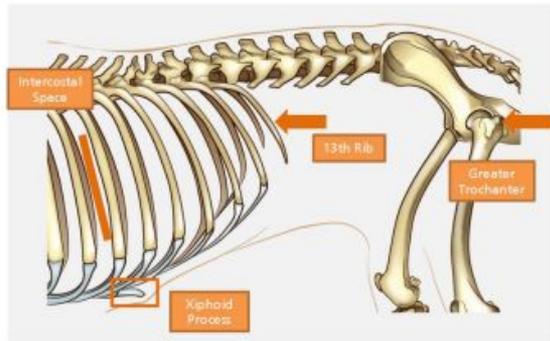
4. Is there a positioning marker present? Is it on the correct side of the patient, not obscuring anatomy and legible? Is the patient ID information correct on the image or file?

Abdominal Technique

1. Check the anatomical boundaries

Lateral

Anatomy Boundaries Needed



Cranial: the 3 intercostal spaces cranial to the xiphoid process

Caudal: the greater trochanter of the femur

The beam should be centered at the 13th (or last) rib

The entire diaphragm to the greater trochanter should be visualized

2. Is the patient straight? Is the positioning appropriate?

Checklist

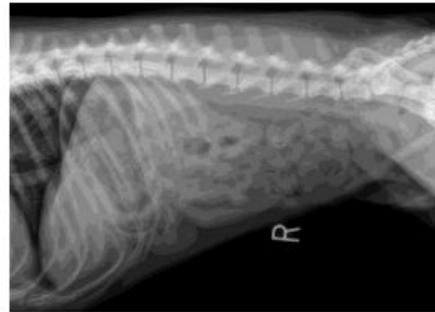
- ✓ Patient right side down (for right lateral view)
- ✓ Extend forelimbs and hindlimbs out of area of collimation
- ✓ Positioning devices can be used to prevent obliquity and restrain the patient
- ✓ Collimate to landmarks
- ✓ Verify positioning
- ✓ Capture image upon expiration



3. Is the technique appropriate? Is the background black? Can you see the needed anatomy including soft tissues?

Lateral

Anatomy Commonly Seen



- caudal vena cava
- liver
- spleen
- stomach
- diaphragm
- kidneys
- small intestine
- colon
- bladder

- There should be superimposition of the transverse processes on the lateral view.
- The disc spaces in central portion of image should be easily visualized and symmetrical if the spine is straight and technique is correct.

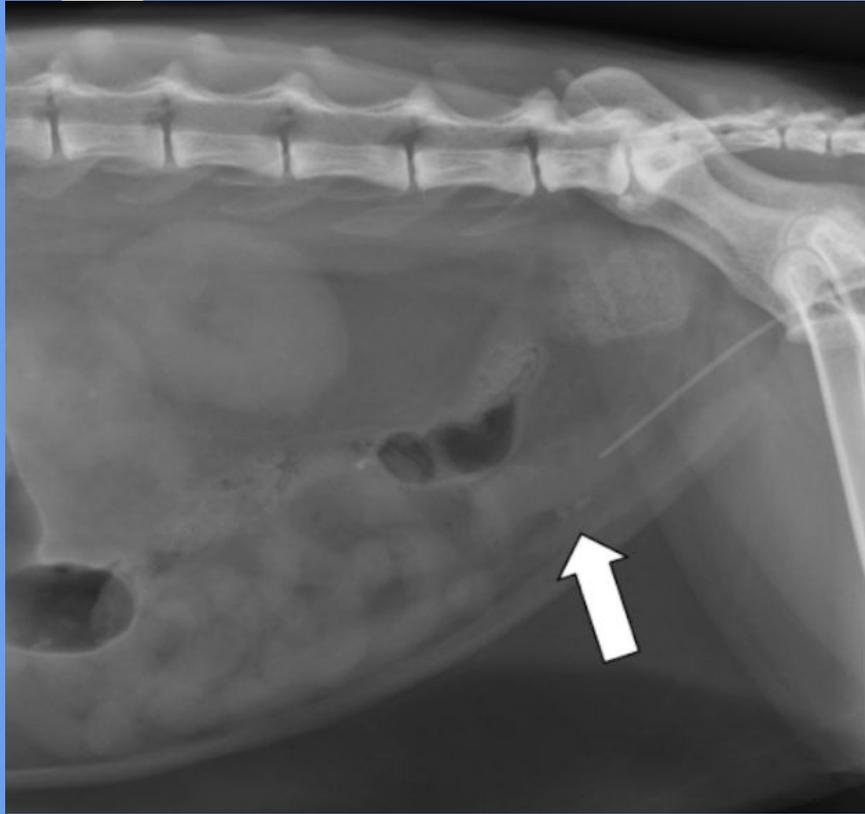
- ## 4. Is there a positioning marker present? Is it on the correct side of the patient, not obscuring anatomy and legible? Is the patient ID information correct on the image or file?

Special Circumstances

—
BOOTY-licious



The Perineum - It's Important!



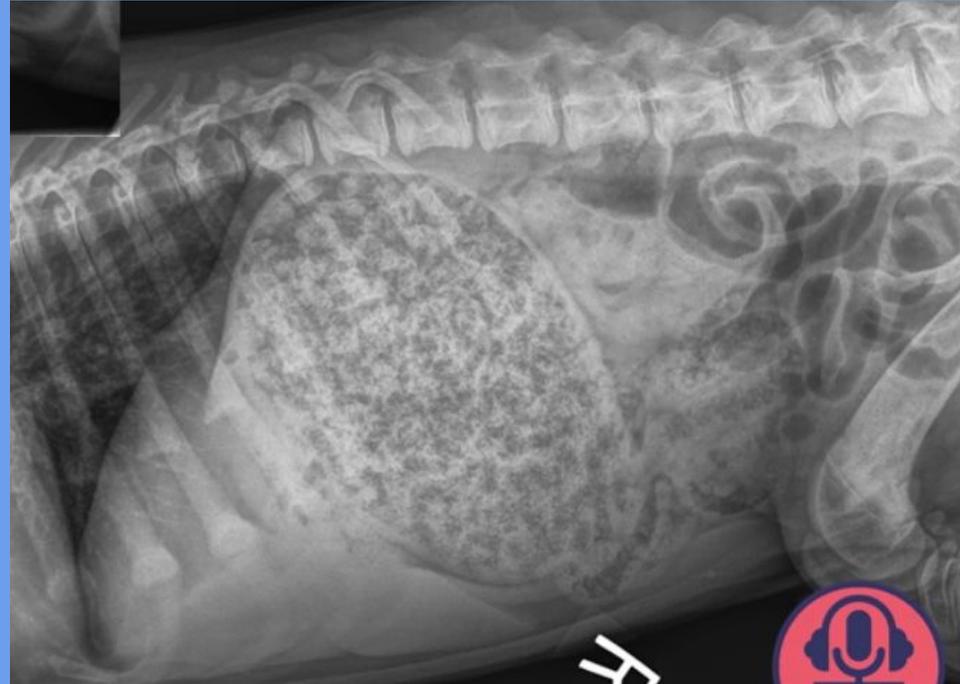
The Perineum - It's Important!



PANTING



Panting = Artifact Motion!



Panting = Artifact Motion!

Techniques to stop panting:

- Distraction
 - Make a loud/noticeable sound
 - Hold an alcohol swab by nose
 - Gently blow on patient's face
- Physical prevention
 - Place very temporary muzzle

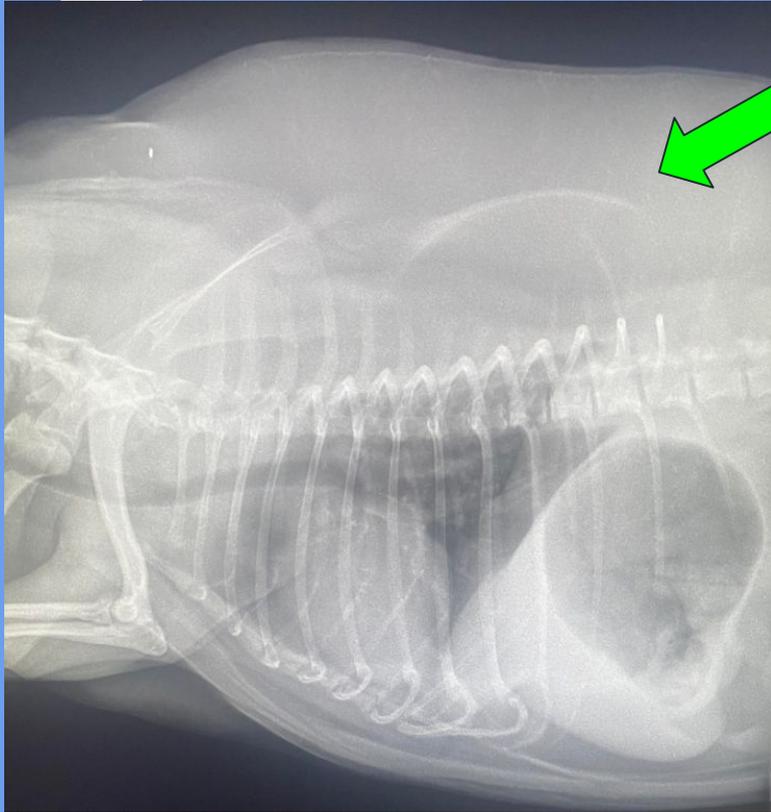
TOO BIG

CHONK



OH LAWD HE COMIN'!

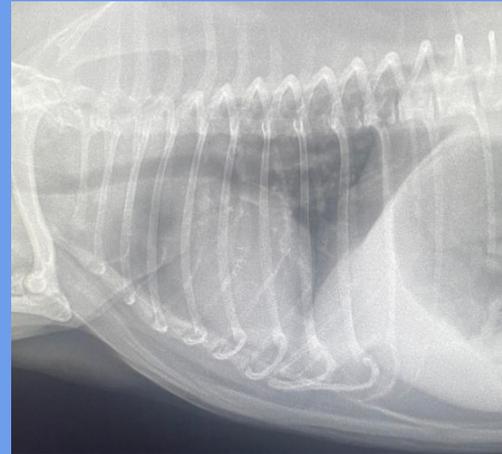
Super Chunks Don't Fit – What Can I Cut?



All this dorsal stuff is back fat and muscle!

Want to see what's in the thoracic cavity, so:

- Keep the sternum
- Chop out the dorsal part



—

Assessment Challenge - Make These Better!

X-Ray Fails - Lateral Thorax

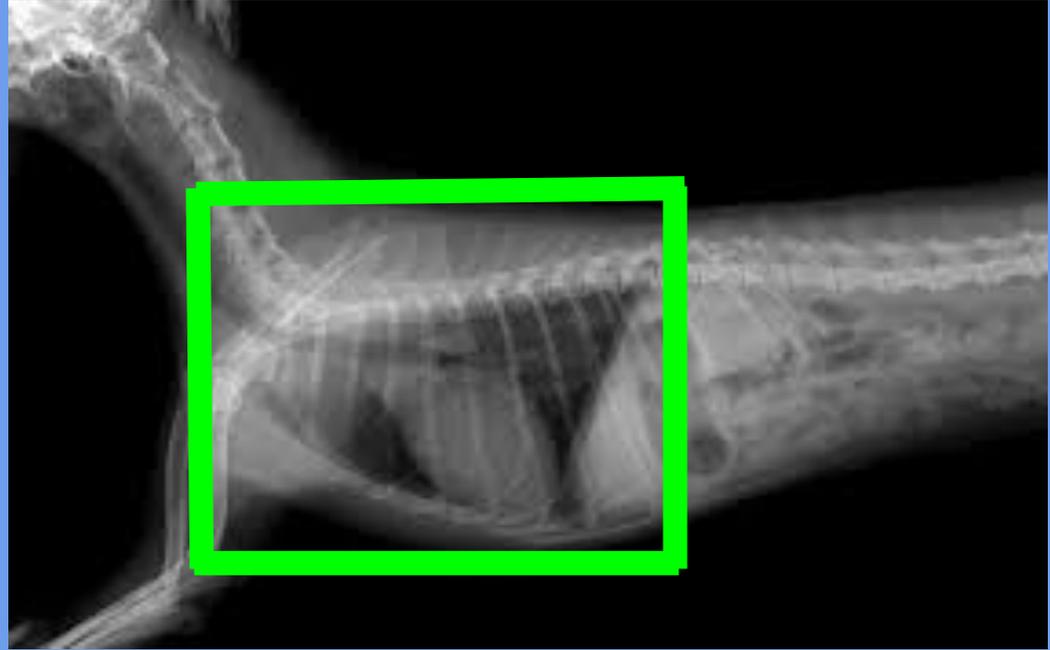
Need more caudal anatomy

Need less caudal anatomy

Need more cranial anatomy

Need less cranial anatomy

Need a marker



X-Ray Fails - Lateral Abdomen

Need more caudal anatomy

Need less caudal anatomy

Need more cranial anatomy

Need less cranial anatomy

Need a marker



X-Ray Fails - Lateral Thorax

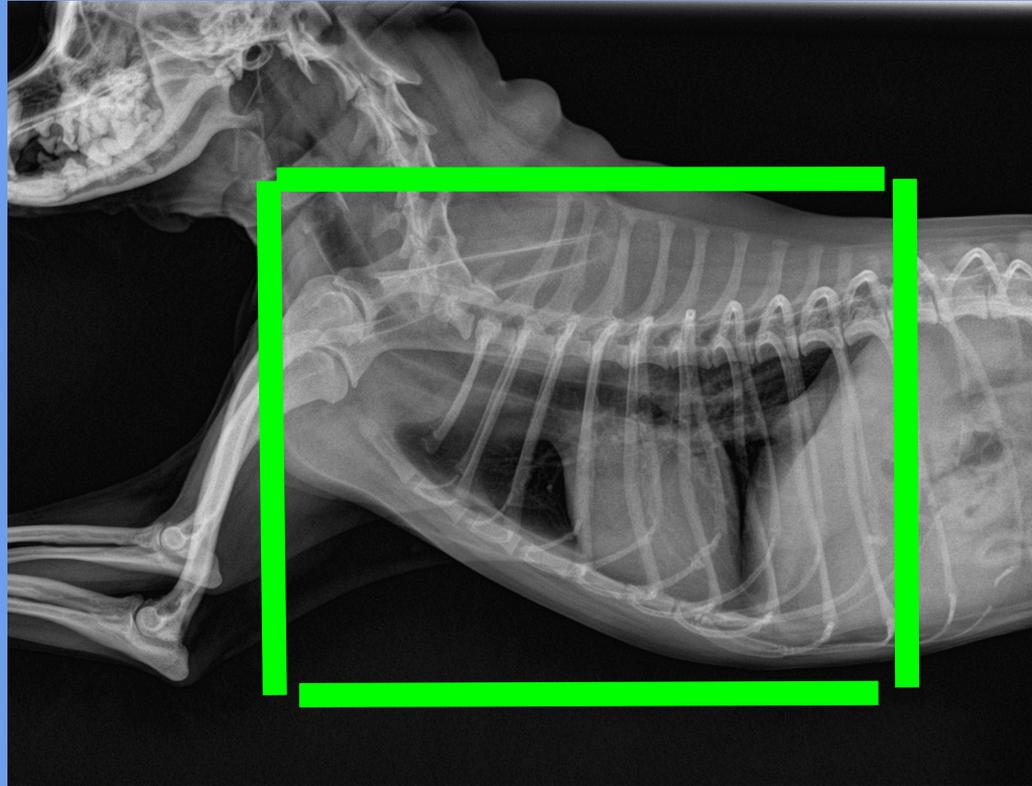
Need more caudal anatomy

Need less caudal anatomy

Need more cranial anatomy

Need less cranial anatomy

Need a marker



X-Ray Fails - Lateral Abdomen

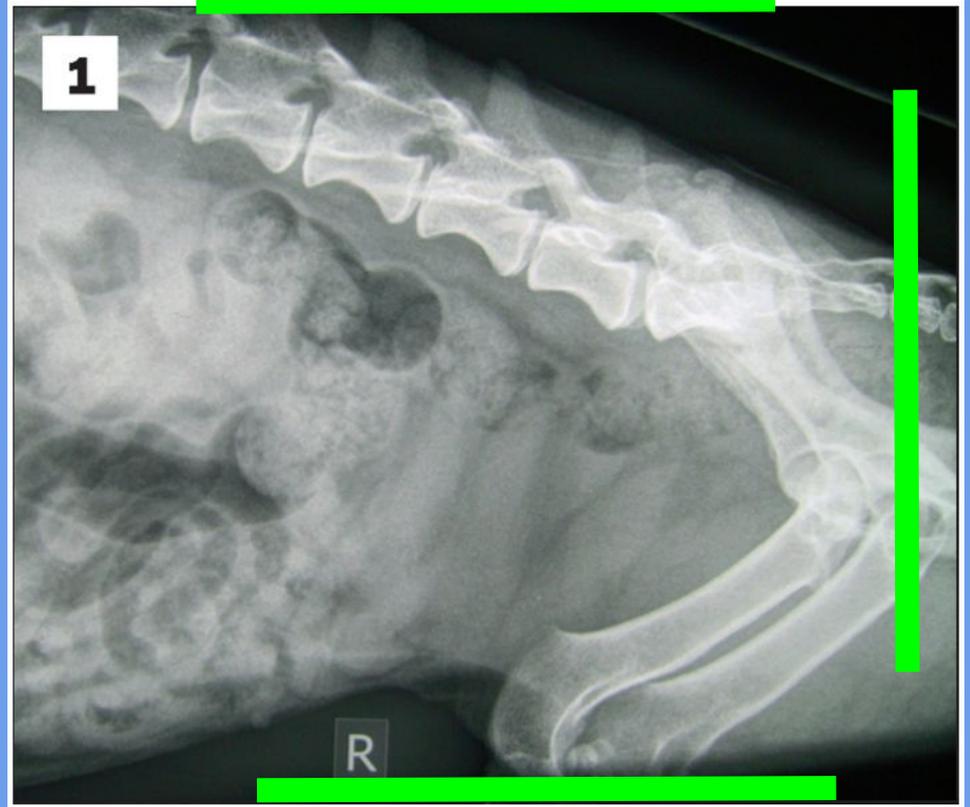
Need more caudal anatomy

Need more cranial anatomy

Need to dry patient off

Need to extend hind legs

Correct mild rotation



X-Ray Fails - Lateral Abdomen

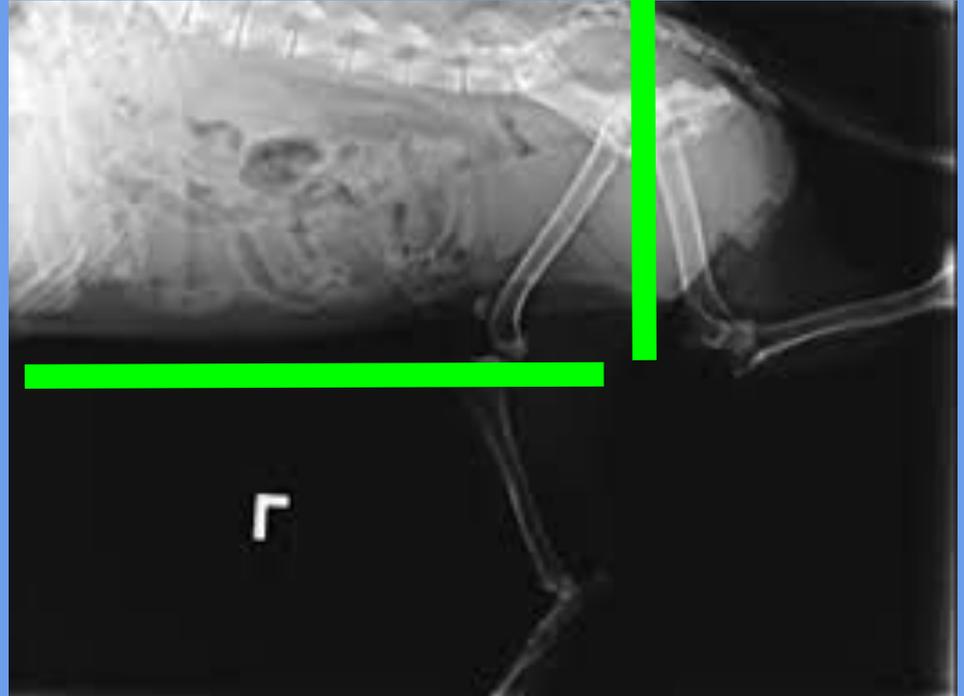
Need more caudal anatomy

Need more cranial anatomy

Need more dorsal anatomy

Need more ventral anatomy

Need to extend hind legs



X-Ray Fails - V/D Thorax

Need more caudal anatomy

Need more cranial anatomy

Need forelimbs extended

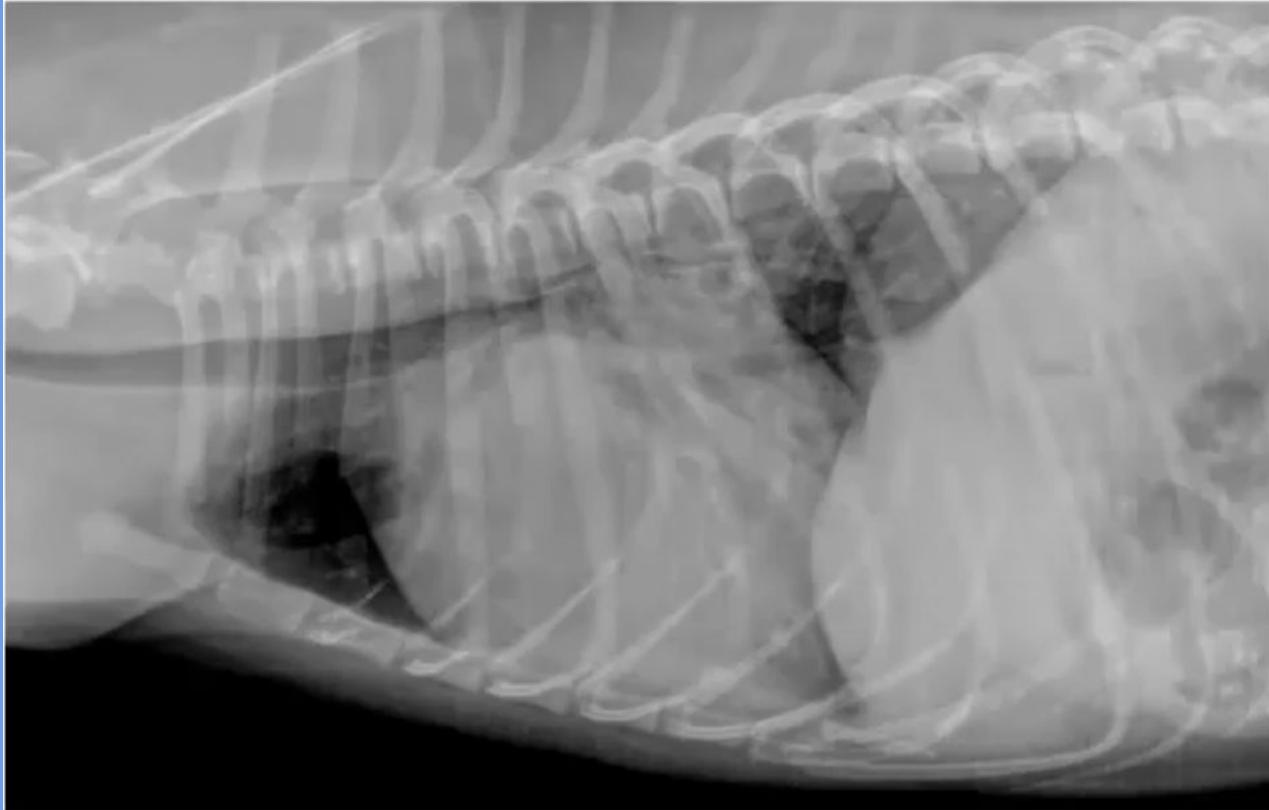
Need patient straighter

Anything else?



Diagnostic or Not?

—
No!



Expiration

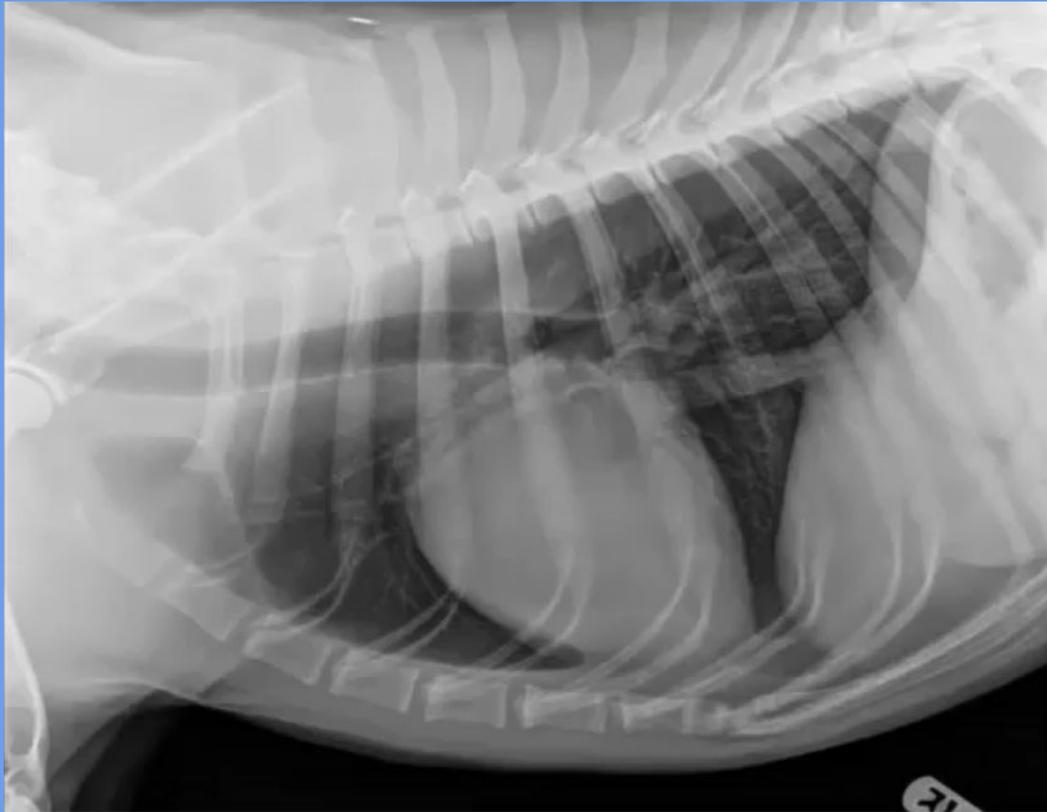
Rotation

Margins

Marker

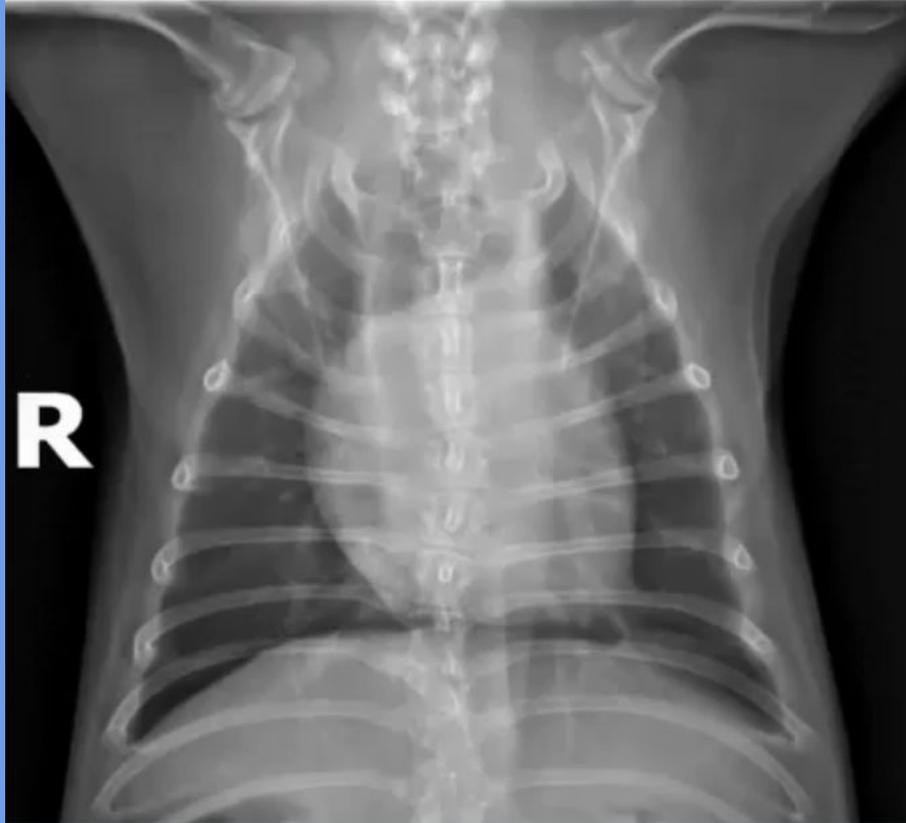
Diagnostic or Not?

—
Yes!



Diagnostic or Not?

—
Yes!



Diagnostic or Not?

—
Yes!



Diagnostic or Not?

—
No!



Expiration

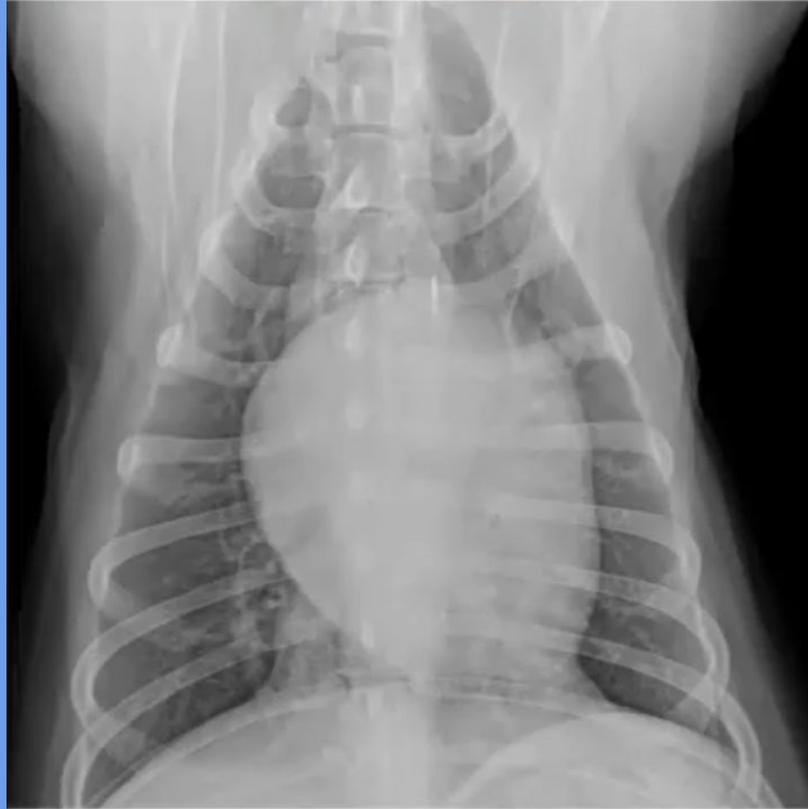
Rotation

Margins

Exposure

Diagnostic or Not?

—
No!



Expiration

Rotation

Marker

Diagnostic or Not?

—
Yes!



Chondrodystrophic

Spinal rib heads
appear mildly
rotated

BUT

Costochondral
junctions at same
level

Sneak Peek at Upcoming CE...

Orthopedic Positioning - It's Important!



Orthopedic Positioning - It's Important!



Thanks!