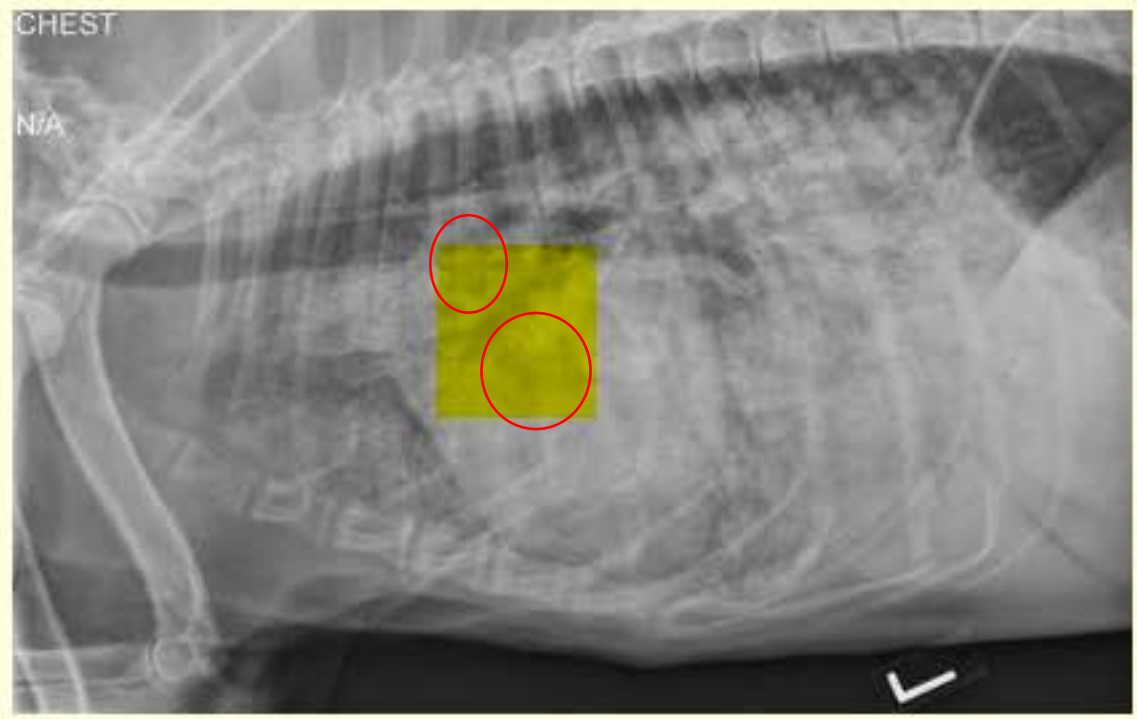


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What is indicated by the highlighted area in the radiograph seen below?



Vascular pattern	HIDE
Megaesophagus	HIDE
Hilar lymphadenopathy	HIDE
Air bronchogram	HIDE
Tracheal carina	HIDE

1	2	3	4	5	6	7	8	9	10
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What is i



CHEST  
N/A

**Correct: Air bronchogram**

The air **bronchogram visible over** the **cardiac silhouette** is a hallmark of the **alveolar pattern**. When **tiny alveolar airspaces are infiltrated** with inflammatory fluid, hemorrhage or neoplasia, the soft-tissue opacity highlights the larger airways. Click here to see [air bronchograms](#) on a DV view.

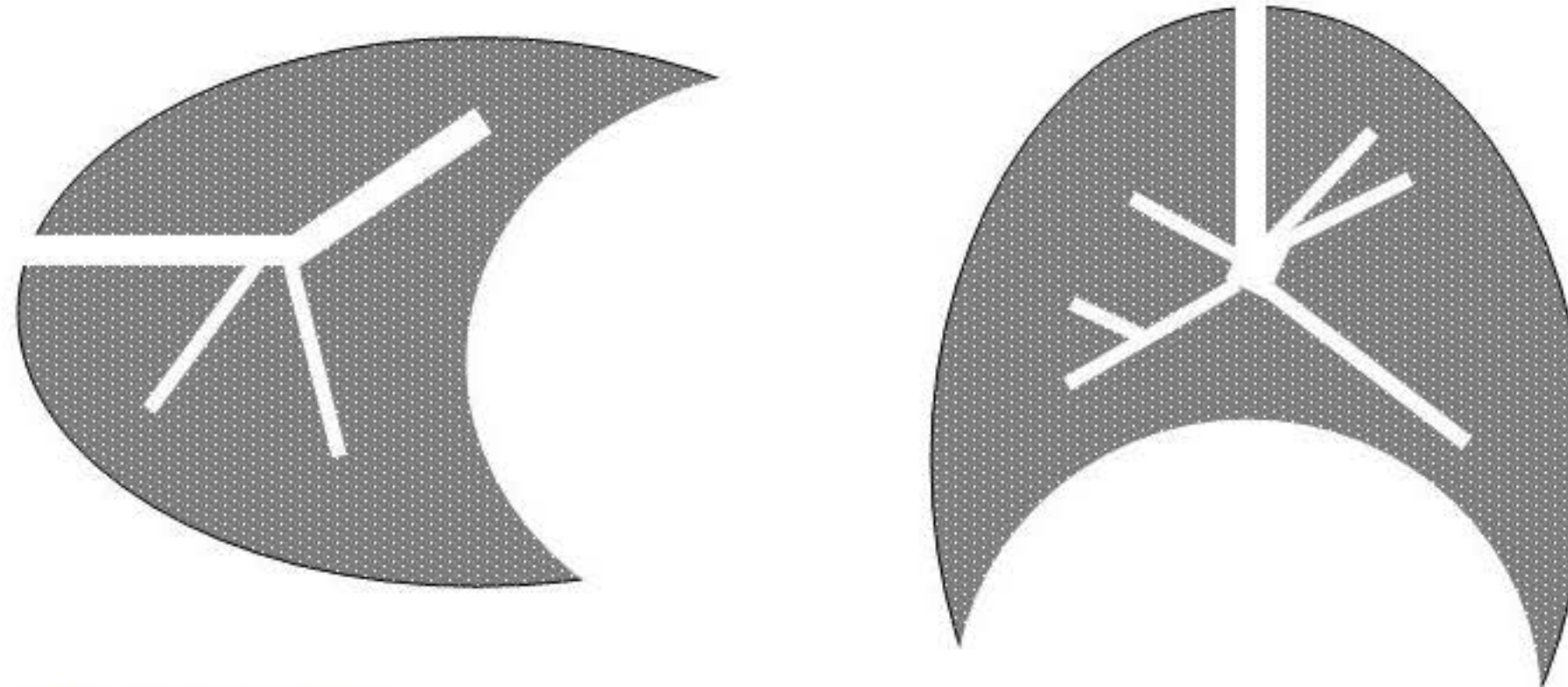
Click here to see [enlarged and tortuous pulmonary arteries](#) in the lung fields of a dog with severe heartworm.

Refs: Pasquinis and Spurgeon, Anatomy of Dom Animals, 11th ed. pp. **620**, 614-625 and the Merck Veterinary Manual online edition. Image courtesy of Dr. Terri DeFrancesco, Copyright 2017, All rights reserved.

Vascular	
Megaesophagus	HIDE
Hilar lymphadenopathy	HIDE
Air bronchogram	HIDE
Tracheal carina	HIDE



## Radiographic lung patterns: **Alveolar**



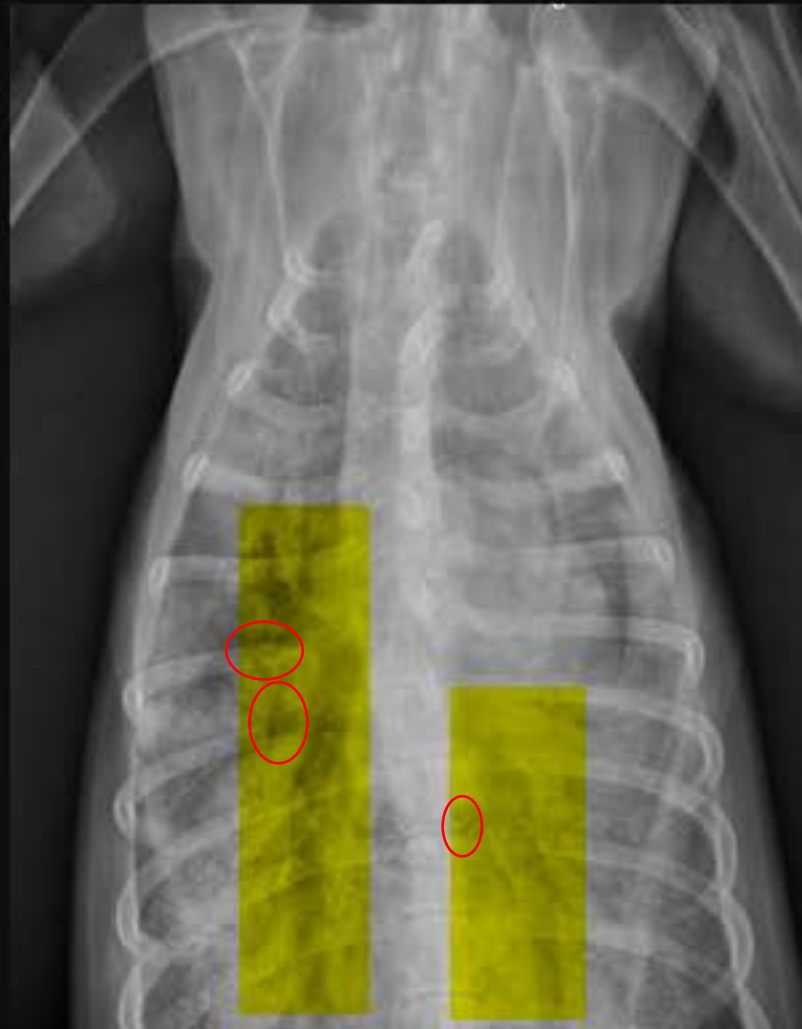
**Alveolar pattern:** When tiny alveolar airspaces are infiltrated with inflammatory fluid, hemorrhage or neoplasia, the soft-tissue opacity highlights the larger airways creating hallmark dark “air-bronchograms”

For excellent examples of alveolar patterns and more, see the VetGo discussion of thoracic rads:  
<http://www.vetgo.com/cardio/concepts/concsect.php?conceptkey=20292#>

**Adapted from:** Pasquini & Spurgeon, Anatomy of Domestic Animals, 11th ed. pp. 620, 614-625



## air bronchograms on a DV view







**enlarged and tortuous PULmonary- arteries  
in the lung fields of a dog  
with severe heartworm**

Courtesy of the University of Florida.

Severe radiographic lesions of canine heartworm disease in a 6-yr-old Boxer, lateral projection. Note dorsal displacement of the apex of the heart, severely enlarged and **tortuous** pulmonary arteries, and moderately increased bronchointerstitial pulmonary infiltrate. Small metallic pellets in the soft tissues are incidental findings.

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Which factor has the greatest influence on radiographic contrast?

mAs	HIDE
kVp	HIDE
Humidity of film storage area	HIDE
Scatter radiation	HIDE
Focal-film distance	HIDE

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PREV

1

Which fa

mAs

kVp

Humidit

Scatter

Focal-film distance

Correct:

Kilovoltage has the greatest influence on radiographic contrast.

Fogging, due to light leakage into the darkroom, or from overdeveloping can also interfere with radiographic contrast.

Too much scatter (ie: from radiographing a thick body part more than 10 cm without a grid) causes gray films.

Milliampere-seconds (mAs) have more effect on the film density (darkness).

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 529-32 and Tighe & Brown, Mosby's Comprehensive Review for Vet Techs, 2<sup>nd</sup> ed. p. 183.

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What does the **anticlinal vertebra** indicate on a **lateral radiograph**?

Vertebra immediately caudal to protruding disc	HIDE
First vertebra after sacrum	HIDE
Anatomical landmark- vertical spinous process	HIDE
Anatomical landmark-spinous process inclines caudally	HIDE
Vertebra immediately cranial to protruding disc	HIDE

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Report a Problem





PREV

1

What do

Vertebra

First ver

Anatom

Anatom

Vertebra

**Correct: Anatomical landmark- vertical spinous process**

The anticlinal vertebra is an anatomical landmark, usually T11 in dogs, where the spinous process is upright or vertical. It is the vertebra where the incline of the spinous processes change from caudal-pointing to cranial-pointing.

Refs: Pasquini & Spurgeon's Anatomy Dom An 11<sup>th</sup> ed. p. 613.

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When taking a radiograph, in what situations will magnification artifact occur?

Underexposure; improper use of the heel effect	HIDE
Improper use of technique chart; x-ray beam not centered on structure being imaged	HIDE
Kilovoltage (kVp) too high; milliamperage-seconds (mAs) too low	HIDE
Grid lines too far apart; angle of anode target too large	HIDE
Focal-film distance too short; patient too far from image receptor	HIDE

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 **1**

When ta  
Underex  
Imprope  
being im  
Kilovolta  
Grid line

**Correct:**

Magnification artifact will occur when the focal-film distance is too short or when the patient is too far from the image receptor.

Grid lines that are too far apart result in an increase in the amount of scatter radiation.

An increase in the angle of the anode target will result in a reduction in image sharpness.

Elongation artifact will occur when the x-ray beam is not centered on the structure being imaged.

Refs: McCurnin and Bassert, Clinical Textbook for Veterinary Technicians, 9<sup>th</sup> ed. pp. 480-98.

Focal-film distance too short; patient too far from image receptor HIDE

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A 9-year-old, male neutered mixed breed dog is presented with a history of occasional vomiting and anorexia.

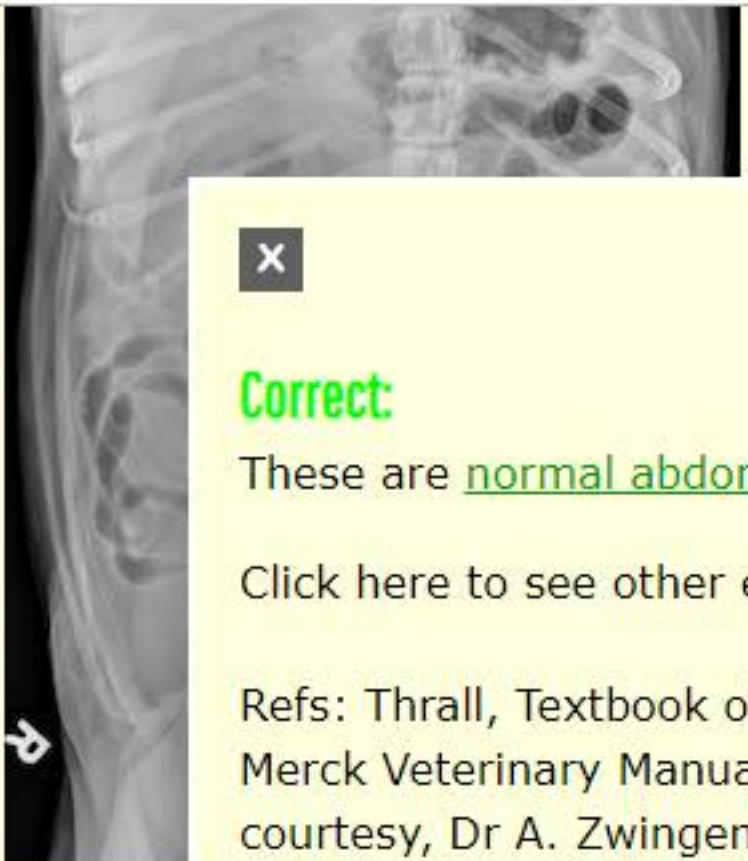
Which one of the following choices is evident from these radiographs?







Splenomegaly	HIDE
Normal radiographs	HIDE
Cystic calculi	HIDE
Gastroenteritis	HIDE
Mesenteric torsion	HIDE



Correct:

These are [normal abdominal radiographs](#).

Click here to see other examples of [normal canine abdominal radiographs](#).

Refs: Thrall, Textbook of Veterinary Diagnostic Radiology 6<sup>th</sup> ed. pp. 650-8 and the Merck Veterinary Manual online edition. Radiographic interpretation and images courtesy, Dr A. Zwingenberger and [Veterinary Radiology](#). Normal radiograph links courtesy, [Imaging Anatomy](#) Univ. of Illinois Vet Med.

- Splenon
- Normal**

Cystic calculi	HIDE
Gastroenteritis	HIDE
Mesenteric torsion	HIDE

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An older adult cat is presented with a chronic history of coughing, wheezing, tachypnea and intermittent respiratory distress, suggesting a diagnosis of **feline asthma**.

What thoracic radiographic pattern is most likely to be prominent?

Bronchial	HIDE
Vascular	HIDE
Mixed alveolar-vascular	HIDE
Alveolar	HIDE
Interstitial	HIDE

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LEAVE BLANK













PREV

1

An older intermittent

What the

Bronchial

Vascular

Mixed al

Correct:

Feline asthma classically demonstrates a bronchial lung pattern on thoracic radiographs (or broncho-interstitial).

The hallmark of a bronchial pattern is irregularly thickened walls of bronchioles that look like "donuts" end-on or "tram tracks" side-on.

For an excellent visual summary of bronchial pattern, see Dr. Allison Zwingenberger's Vet Radiology site.

The other 3 basic lung patterns are:

1. Alveolar pattern, characterized by "air bronchograms".


Alveolar	HIDE
Interstitial	HIDE


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 **PREV**



An older  
intermitt

What the

Bronchia

Vascular

Mixed al

The other 3 basic lung patterns are:

1. [Alveolar pattern](#), characterized by "air bronchograms".
2. [Interstitial pattern](#), characterized by decreased visualization of pulmonary vessels, cardiac and diaphragm silhouettes.
3. [Vascular pattern](#) can suggest either hypervascularity or hypovascularity.

Click here to see [enlarged and tortuous pulmonary arteries](#) in the lung fields of a dog with severe heartworm.

Refs: Pasquinis and Spurgeon, Anatomy of Dom Animals, 11<sup>th</sup> ed. pp. **620**, 614-625, Cote, Clinical Veterinary Advisor-Dogs and Cats, 3<sup>rd</sup> ed. pp. 90-2 and the Merck Veterinary Manual online edition.

Alveolar	<b>HIDE</b>
Interstitial	<b>HIDE</b>

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If you take an x-ray of a dog at 300 milliamperes for 1/20<sup>th</sup> of a second, how many milliampere-seconds is the exposure?

20 mAs	HIDE
600 mAs	HIDE
15 mAs	HIDE
60 mAs	HIDE

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1

If you take  
milliamperes

- 20 mAs
- 600 mA
- 15 mAs
- 60 mAs

Correct:

Together, milliamperes-seconds equals mA multiplied by time (mA X sec=mAs), which controls the intensity of an x-ray.

In this question,  $300 \times 1/20 = 15 \text{ mAs}$ .

Milliamperes (mA) are the QUANTITY of electrons produced by the x-ray machine and exposure time (sec) is how LONG you expose the animal to these rays.

More mA, or longer exposure time, means a DARKER x-ray.

Refs: Bassett and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 529-32 and Mosby's Comprehensive Review for Veterinary Technicians Tighe, Brown, 2<sup>nd</sup> ed. p. 176.

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Focal-film distance is the distance between what two objects

Tungsten target and surface of the x-ray detector	HIDE
Cathode and the anode	HIDE
Bottom of the x-ray tube and the floor	HIDE
Glass envelope and the filament	HIDE
Dorsal and ventral aspect of the structure being radiographed	HIDE


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PREV

1

Focal-film

Tungsten

Cathode

Bottom

Glass envelope

Dorsal and ventral aspect of the structure being radiographed

Correct:

The focal-film distance (FFD) is the distance between the tungsten target in the x-ray tube and the surface of the x-ray detector.

The tungsten target is contained within the anode, which is the positive side of the x-ray tube.

Tungsten is used because it absorbs electrons (produced on the cathode side) without overheating.

The FFD influences many factors, including x-ray beam intensity and the detail of the image.

Ideally, it should be kept constant from one exposure to the next.

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PREV

1

Focal-filr

Tungste

Cathode

Bottom

Glass er

Dorsal and ventral aspect of the structure being radiographed

Doubling the FFD **decreases** the number of x-rays reaching the x-ray detector by a **factor of 4**.

In other words, doubling the FFD will decrease the x-ray beam intensity by  $\frac{1}{4}$ .

When FFD is increased, the energy of the beam (controlled by the kilovoltage (kVp)) must also be increased.

When FFD is decreased, image detail decreases. Increasing FFD will increase image detail, but the kVP must also be increased to maintain proper film density.

Refs: McCurnin and Bassert, Clinical Textbook for Veterinary Technicians, 9<sup>th</sup> ed. pp. 480-489.

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Which of the following monitors used to measure blood pressure detects blood flow using ultrasonic waves?

Photoplethysmograph	HIDE
Doppler	HIDE
Capnograph	HIDE
Oscillometric	HIDE
Pulse oximeter	HIDE

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	✗	✓	✓	✓	M ✓	✗	✓	✗	✗		

Which of  
ultrasoni

- Photoplethysmography
- Doppler
- Capnography
- Oscillometry
- Pulse oximetry

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Correct:

A Doppler emits ultrasonic waves from a piezoelectric crystal located in the probe that is placed over a peripheral artery. This probe receives waves returning from the tissue and the monitor converts the information into an audible signal.

A sphygmomanometer cuff is placed above the artery. When the cuff is inflated and deflated, the sound from the Doppler changes with blood flow. The systolic pressure is identified with return of the audible signal.

The Doppler is a very useful monitor since it produces a sound, evidence of blood flow (or the loss of flow) is readily apparent, increases and decreases in flow and cardiac arrhythmia can be detected.

Refs: McCurnin's Clin Textbk for Vet Techs, 8<sup>th</sup> ed. pp. 928-30, 1108-9, and Thomas

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[Change My Background Colors](#)



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✗	✓	✓	✓	M ✓	✗	✓	✗	✗	

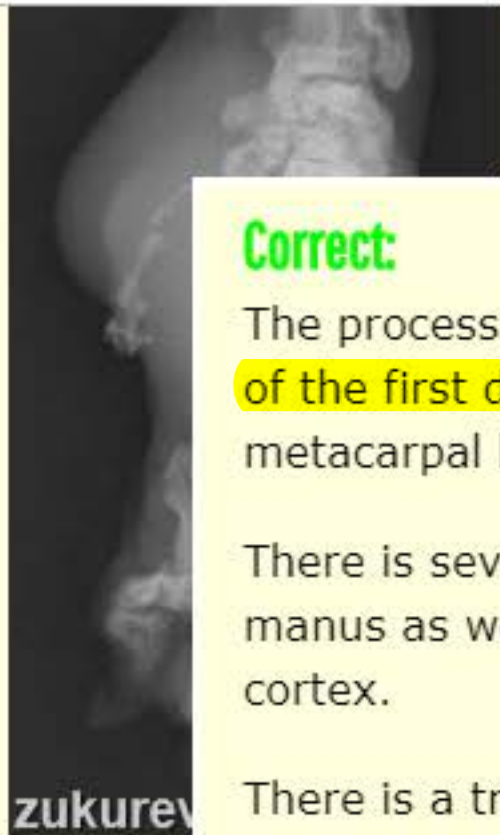
What is the most likely process involving this cat's right front paw?





Neoplastic	HIDE
Traumatic	HIDE
Immune-mediated	HIDE
Nutritional	HIDE
Degenerative	HIDE





**Correct:**

The process is highly likely to be neoplastic. There is severe lysis of all of the bones of the first digit of the right manus, with nearly complete destruction of the metacarpal bone and proximal phalanx.

There is severe regional soft tissue swelling over the medial aspect of the right manus as well. The second metacarpal bone has thinning and irregularity of the cortex.

There is a transverse fracture in the mid diaphysis of the third metacarpal bone, the margins of the fractures are irregular and there is a moderate irregular periosteal proliferation present circumferentially around the fracture.

Click here to see [normal feline carpus and foot radiographs](#).

Neoplas

Traumat

Immune-mediated

Nutritional

Degenerative

HIDE

HIDE

HIDE

BACK

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Plain	All Layers	Carpal Pad	Radial Carpal
Medial Styloid Process	Lateral Styloid Process		
Accessory Carpal	Ulnar Carpal	Carpal I	Carpal II
Carpal III	Carpal IV		



Plain	All Layers	Spoon	P1 or Digit II	P2 or Digit IV
Proximal Phalanx of Digit I	Metacarpal I	Metacarpal IV		
Ungual Process of Digit III	Distal Phalanx of Digit I	P3 of Digit V		
Proximal Sesmoids of Digit I & IV	Sesmoid of abductor pollicis longus			





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Which tissue is likely to produce an ultrasound artifact called through transmission (also called acoustic enhancement)?

Stomach	HIDE
Muscle	HIDE
Lung	HIDE
Adrenal gland	HIDE
Gallbladder	HIDE

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11 

- Which tissue is called acoustic enhancement?
- Stomach
- Muscle
- Lung
- Adrenal

Gallbladder. **Gallbladder**

**Through transmission** (also called acoustic enhancement) happens when ultrasound hits nonattenuating structures, and the emerging ultrasound beam will have higher intensity (and image will be brighter) behind the low attenuation region.

For example, if you shine ultrasound through the **gallbladder** and liver, there is a bright beam below the gall bladder almost like a search light, compared to the darker areas of surrounding liver which has attenuated the beam more.

**Reverberation artifact** occurs when ultrasound meets strong reflectors like **gas** (in lungs for example) or **bone**.

It looks like a comet tail with bright parallel evenly spaced lines. (See McCurnin Figs 16-47 and 48 for good pictures)

Gallbladder **HIDE**

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Which one of the following choices is an example of a soluble nonionic radiopaque contrast material?

Iothalamate	HIDE
Iohexol	HIDE
Diatrizoate	HIDE
Barium sulfate	HIDE
Air	HIDE

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11 

Which of the following materials is a soluble nonionic radiopaque contrast media?

- Iothalamate
- Iohexol
- Diatrizoate
- Barium

Air HIDE

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Correct:

Iohexol, iotolan and lopamidol are examples of soluble nonionic radiopaque contrast media.

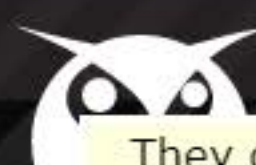
These compounds can be used in blood vessels, draining wounds (fistulography), salivary ducts (sialography), in the urinary tract, intraarticularly, and intrathecally (myelography).


They can also be administered orally for gastrointestinal (GI) studies.

These contrast agents have a lower osmolarity and less risk of adverse effects compared to ionic organic iodides (iothalamate, diatrizoate).

Click here to see some [examples of contrast studies](#) on The Ohio State University's website.





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**11**

Which or  
material

- Iothalan
- Iohexol
- Diatrizo
- Barium**

Air HIDE

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They can also be administered orally for gastrointestinal (GI) studies.

These contrast agents have a lower osmolality and less risk of adverse effects compared to ionic organic iodides (iothalamate, diatrizoate).

Click here to see some [examples of contrast studies](#) on The Ohio State University's website.

**Barium sulfate** is an insoluble, inert radiopaque contrast used almost **exclusively for upper and lower GI studies.**

Refs: McCurnin and Bassert, Clinical Textbook for Veterinary Technicians, 9<sup>th</sup> ed. pp. 507-8.

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Which type of transducer is used for transrectal examination in horses?

Phased array sector	HIDE
Broad bandwidth	HIDE
Linear array	HIDE
Mechanical sector	HIDE
Concave	HIDE

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11

Which ty

Phased

Broad b

Linear a

Mechani

Concave

Correct:

Linear array transducers are used for transrectal examination (pregnancy checking and ovary exam) and tendon examination. They produce a rectangular cross section image.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. p. 553 and Tighe and Brown, Mosby's Comprehensive Review for Vet Techs, 3<sup>rd</sup> ed. p. 196.

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What kind of artifact can occur when ultrasound waves hit uroliths (e.g., bladder stones)

Acoustic enhancement	HIDE
Through transmission	HIDE
Mirror image	HIDE
Reverberation	HIDE
Shadowing	HIDE

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11

What kind of artifact is shown in the following image?

Mirror image

Reverberation

Through-transmission

Acoustic enhancement

Shadowing

**Correct:**

**Shadowing** occurs when ultrasound hits highly reflective structures like **uroliths** (e.g., bladder stones).

**Acoustic shadowing** is a dark area distal to the highly dense material. Basically, stones (or bone) block the ultrasound beam.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 554-5 and the Merck Veterinary Manual online edition.

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If a dog is positioned in dorsal recumbency for a radiograph, which part gets hit by the x-rays first?

Ventral	HIDE
Anterior	HIDE
Lateral	HIDE
Oblique	HIDE
Dorsal	HIDE

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11

If a dog  
rays first

Ventral

Anterior

Lateral

Oblique

Dorsal

HIDE

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11	12	13	14	15	16	17	18	19	20
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Which one of the following choices correctly defines what a unit of Gray (Gy) measures in radiology?

Absorbed dose of ionizing radiation by a unit mass of material	HIDE
Quantity of x-ray photons produced by anode	HIDE
Energy produced by x-ray beam	HIDE
Degree of echogenicity in an ultrasound image	HIDE
Distance between target in x-ray tube and surface of the x-ray detector	HIDE

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11

Which of the following is a radiology term?

Absorbed dose

Quantity

Energy

Degree

**Correct:** Absorbed dose of ionizing radiation by a unit mass of material

The absorbed dose of ionizing radiation by a unit mass of irradiated material is measured in Gray (Gy).

Understanding such measurements is important in regards to radiation safety for patients and personnel.

Milliamperage is a measure of the quantity of x-ray photons (a.k.a. the number of x-rays) produced by the anode.

Kilovoltage is a measure of the energy produced by an x-ray beam.

The focal-film distance is the distance between the tungsten target in the x-ray tube and the surface of the x-ray detector.

Distance between target in x-ray tube and surface of the x-ray detector

HIDE

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## Radiation Safety:

Radiographic examinations must be performed with **proper respect for radiation safety procedures**. **Diagnostic x-ray machines** are potent sources of radiation and can, if improperly used, **result in injurious exposure to personnel over time**. The exposure factors used in modern x-ray systems are substantially lower than those used in the past but can still result in injury. **It is never acceptable to hold animals without the use of lead-impregnated aprons and gloves to decrease exposure to the hands and body of personnel from scattered radiation**. **Leaded gloves should not be used within the primary beam of the x-ray machine**. These gloves and aprons **reduce** exposure from **scatter radiation** by a factor of **~1,000** **but reduce** exposure from the **primary beam** by **only a factor of ~10**. Thyroid shields are considered mandatory, and eye shields in the form of lead-impregnated plastic "**glasses**" are also recommended, especially when radiographing large animals, because the exposures used are sometimes quite high and the orientation of the beam is more likely to be horizontal. Upper limb, cervical spine, and skull studies in horses are particularly likely to result in substantial exposure to anyone holding the film/detector or the horse.

Proper collimation of the x-ray beam is an important and integral part of radiation protection. If the x-ray beam extends beyond the animal, then that radiation contributes to increased scatter radiation and personnel exposure. Any image in which the entire field of the detector or film is exposed is probably under-collimated, unless the animal extends to the limits of the detector. In addition, with digital radiography systems, **excessive amounts of exposure outside the subject** can **result in false interpretation of the data** by the reconstruction algorithm and substantially degrade image quality. If this occurs, the exposure must be repeated with proper collimation to achieve an acceptable image. In most instances, the x-ray beam should be collimated to ~1 cm outside the subject limits to provide optimal image quality and radiation protection for personnel.

Pregnant women and any personnel <18 yr old should refrain from direct involvement in taking radiographic images whenever possible. **If a pregnant woman** is directly involved in taking radiographs, **she should wear an apron that completely encircles her abdomen**.

Although federal and state authorities have set maximal limits for both extremities and whole-body radiation exposure for occupationally exposed personnel, the principal of "as low as reasonably achievable" (ALARA) should always be adhered to. The currently set limits allow occupational whole-body exposure to be roughly the same as that which occurs from environmental sources. However, in many veterinary teaching hospitals with large radiographic case loads, the occupational exposure is held to <10% of the permitted values by use of proper protective equipment and radiographic techniques. There is no reason for veterinarians or technicians in private practice to



ever receive exposures approximating the allowed limits unless they are heavily involved in specialized interventional radiography.

Individuals involved in taking radiographic images should be monitored for radiation exposure. This is essential to identify and correct conditions that can result in excessive radiation exposure to personnel. Monitoring of exposure also provides evidence of proper adherence to radiation safety standards if questions arise as to whether an employee's medical condition could be related to radiation exposure. Several companies provide this service for a relatively nominal fee.

**zukureview**

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11	12	13	14	15	16	17	18	19	20
✓	✓	✓	✓	✓	M ✓				

If you double the focal-film distance between an x-ray source and the x-ray cassette, what happens to the x-ray beam intensity on the x-ray cassette?

Double the intensity	HIDE
Four-fold increase in intensity	HIDE
No difference	HIDE
One-quarter the intensity	HIDE
Half the intensity	HIDE

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 **SAVE & EXIT**

**Correct: One-quarter the intensity**


An increase in distance between the film and the x-ray source **DECREASES** the **x-ray intensity** by a factor of **FOUR**.


That is, if you double the distance between an x-ray source and the film, your x-ray beam strength decreases to 1/4 .

Sometimes you have to change the focal distance when you change an animal's position (e.g., from a lateral to a dorso-ventral position, for two radiographic views).

**To keep x-ray exposure the same**, calculate a new mAs setting this way if you are going from a shorter distance (like 50cm) to a longer distance (like 100cm):

If you took one x-ray at 2.5 mAs from 50 cm, and now you need to take another x-ray from 100 cm, what is your new mAs setting.

 **PREV**

**11** 

If you do happens

Double t

Four-fol

No diffe


**One-quarter**

Half the intensity

HIDE

**BACK** **NEXT**



 **SAVE & EXIT**

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**11** 

If you double the focal distance, what happens to the mAs?

- Double the mAs
- Four-fold increase in mAs
- No difference
- One-quarter the mAs

Half the intensity HIDE

**BACK** **NEXT**











ray from 100 cm, what is your new mAs setting.

100cm divided by 50cm = 2

If you double the focal distance, you need to increase the mAs by a factor of 4.

2.5 mAs MULTIPLIED by 4 = 10 mAs

If you are going from a farther distance (like 100cm at 10 mAs) to a shorter distance (like 50cm) DIVIDE 10 mAs by 4.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 529-32.



PREV	11	12	13	14	15	16	17	18	19	20	NEXT
	✓	✓	✓	✓	✓	M ✓	✓				

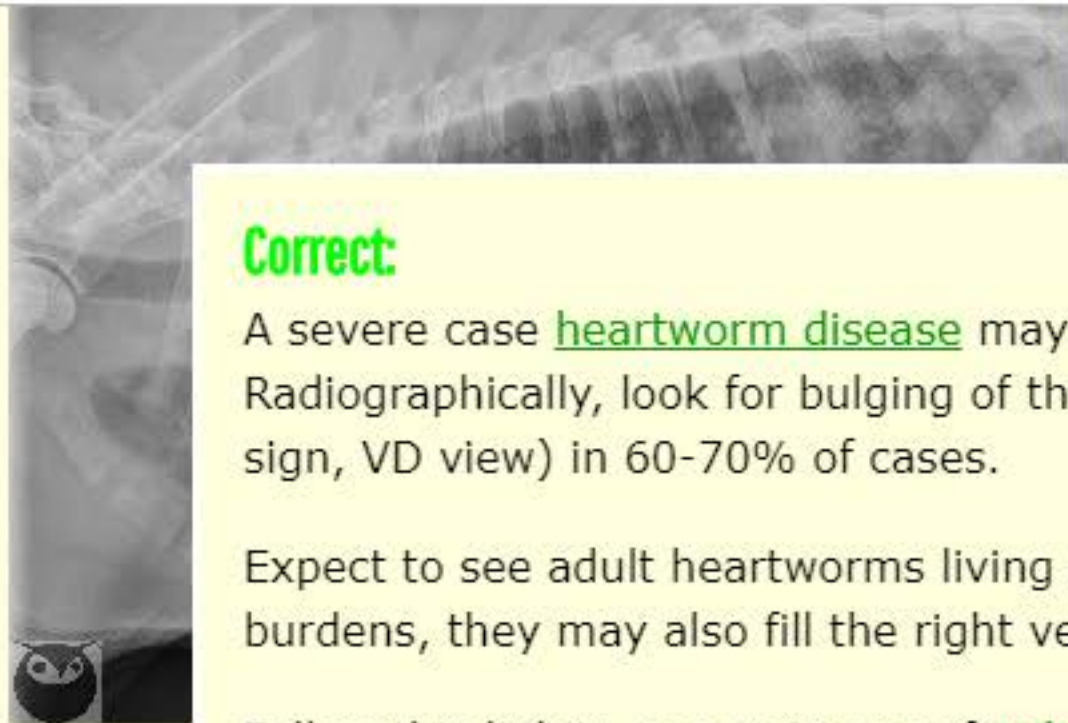
Which one of the following disease processes is most likely with the dog in this image?





Dilated cardiomyopathy	HIDE
Heartworm disease	HIDE
Unilateral pneumothorax	HIDE
Pericardial effusion	HIDE
Left ventricular heart failure	HIDE





### Correct:

A severe case [heartworm disease](#) may exhibit the "reverse D" sign, on VD view. Radiographically, look for bulging of the **main pulmonary artery** ("pulmonary knob" sign, VD view) in 60-70% of cases.

Expect to see adult heartworms living primarily in the pulmonary arteries. With high burdens, they may also fill the right ventricle.

Follow this link to see an image of [milder "pulmonary knob" sign](#).

Follow these links to see radiographs from canine heartworm cases with [right ventricular enlargement](#) (tortuous pulmonary arteries and increased sternal contact-looks like it is lying down) and ["reverse D" sign](#).

Refs: Pasquini's, Tschauner's Guide to Sm An Clin, vol 1, 2<sup>nd</sup> ed. pp. 202-5, Pasquini

Dilated

Heartwo

Unilater

Pericardial effusion

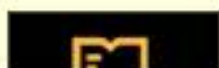
HIDE

Left ventricular heart failure

HIDE

BACK

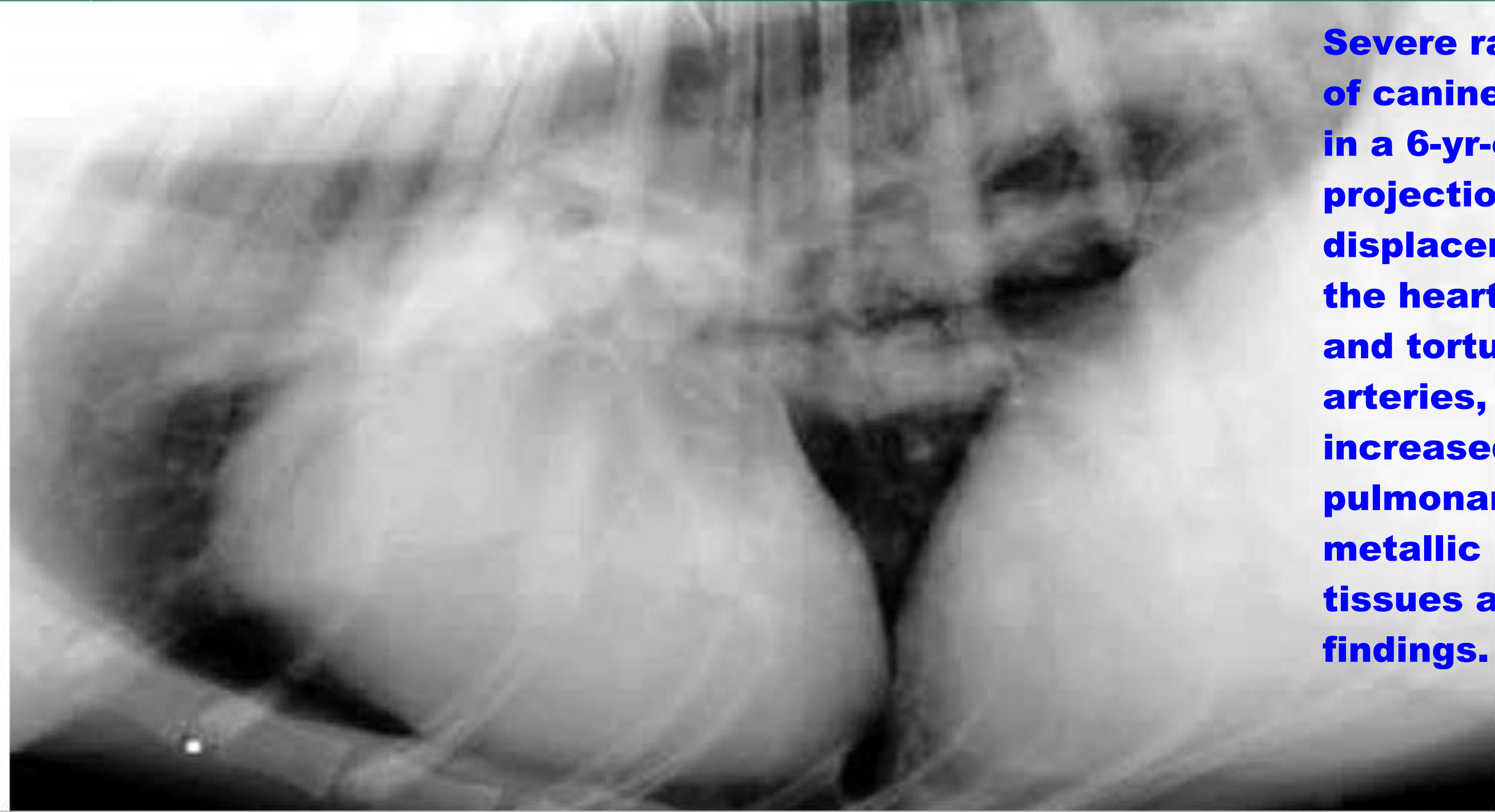
NEXT





**Mild canine heartworm disease in a 5-yr-old German Shepherd, ventrodorsal projection.**  
**-Note enlargement of the right caudal lobar pulmonary artery (greater than the width of the ninth rib)**  
**-and the small bulge in the region of the main pulmonary artery.**





**Severe radiographic lesions of canine heartworm disease in a 6-yr-old Boxer, lateral projection. Note dorsal displacement of the apex of the heart, severely enlarged and tortuous pulmonary arteries, and moderately increased bronchointerstitial pulmonary infiltrate. Small metallic pellets in the soft tissues are incidental findings.**



**Severe radiographic lesions of canine heartworm disease in a 6-yr-old Boxer, ventrodorsal projection. Note the moderate to severe right-side cardiomegaly producing a "reverse D" appearance and the bulge in the region of the main pulmonary artery.**



 **zukureview**

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11	✓	12	✓	13	✓	14	✓	15	✓	16	M	✓	17	✓	18	✓	19		20
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Which one of the following choices correctly describes why **elongation** artifact occurs in radiography?

The structure being radiographed is not in contact with the table	HIDE
The x-ray beam is more intense at the cathode side compared to the anode side	HIDE
The x-ray beam is not centered on the radiographed structure	HIDE
The kilovoltage (kVp) is too high	HIDE
The milliamperere-seconds (mAs) setting is too low	HIDE

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**11** 

Which of the following is a radiographic artifact?

The structure is too small

The x-ray beam is not centered

The x-ray beam is too intense

- The kilovoltage (kVp) is too high HIDE
- The milliamperere-seconds (mAs) setting is too low HIDE

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**Correct:**

When the x-ray beam is not centered on the structure being radiographed, the image appears longer than its normal size, creating an elongation artifact.

The heel effect occurs when the x-ray beam is more intense at the cathode side compared to the anode side, resulting in uneven x-ray photon distribution.

This phenomenon is related to the angle of the anode target area and to the absorption of the x-ray beam by the anode target material.

Foreshortening occurs when the structure being radiographed is lifted off the table, causing the structure to appear shorter than its actual size.

Click to see examples of [several radiographic artifacts](#) from The Ohio State University's website.

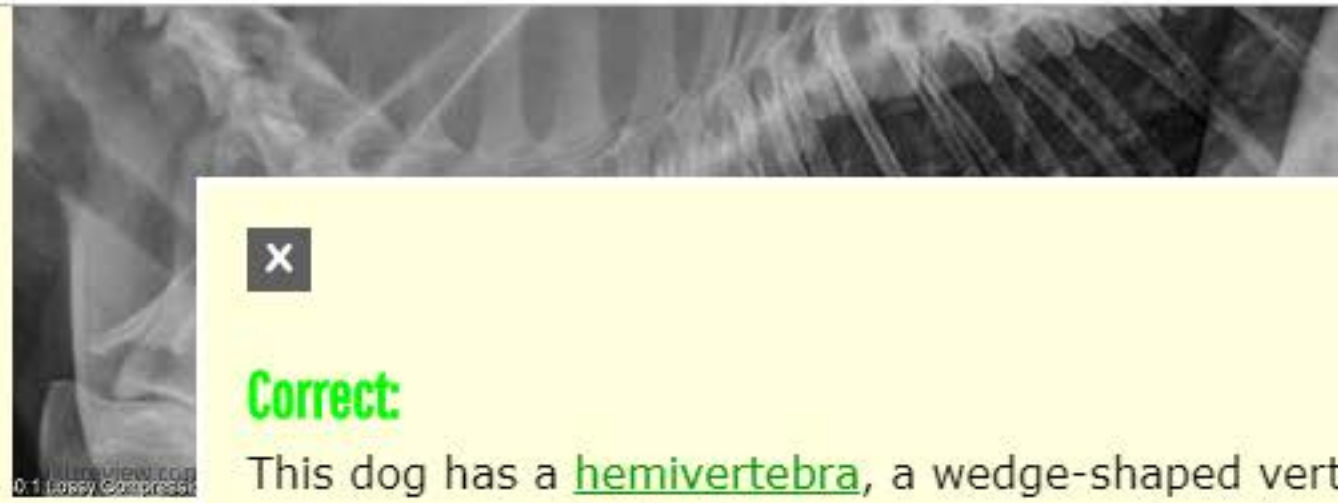


11	✓	12	✓	13	✓	14	✓	15	✓	16	M	✓	17	✓	18	✓	19	✓	20
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What is the primary abnormality seen in this radiograph from this adult pug dog?



Hemivertebra	HIDE
Diskospondylitis	HIDE
Pulmonary emphysema	HIDE
Cartilaginous exostoses	HIDE
T3-L3 intervertebral disc disease	HIDE



**Correct:**

This dog has a [hemivertebra](#), a wedge-shaped vertebra, which can be an asymptomatic finding, or may present with scoliosis, kyphosis, and paresis, ataxia.

Click here to see the same radiograph with an [arrow over the lesion](#).

Typically thoracic. Think of screw-tailed dogs (e.g.: bulldog, pug). Inherited in German shorthaired pointers.

Refs: Pasquini's, Tschauner's Guide to Small Animal Clinics, vol 1, 2<sup>nd</sup> ed. p. 536 and the Merck Veterinary Manual online edition. Image courtesy of Dr. James Montgomery

Hemiver

Diskosp

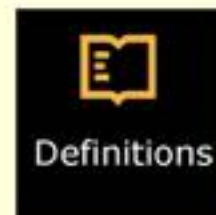
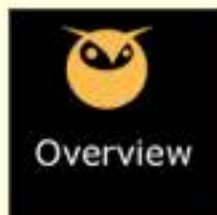
Pulmona

Cartilag

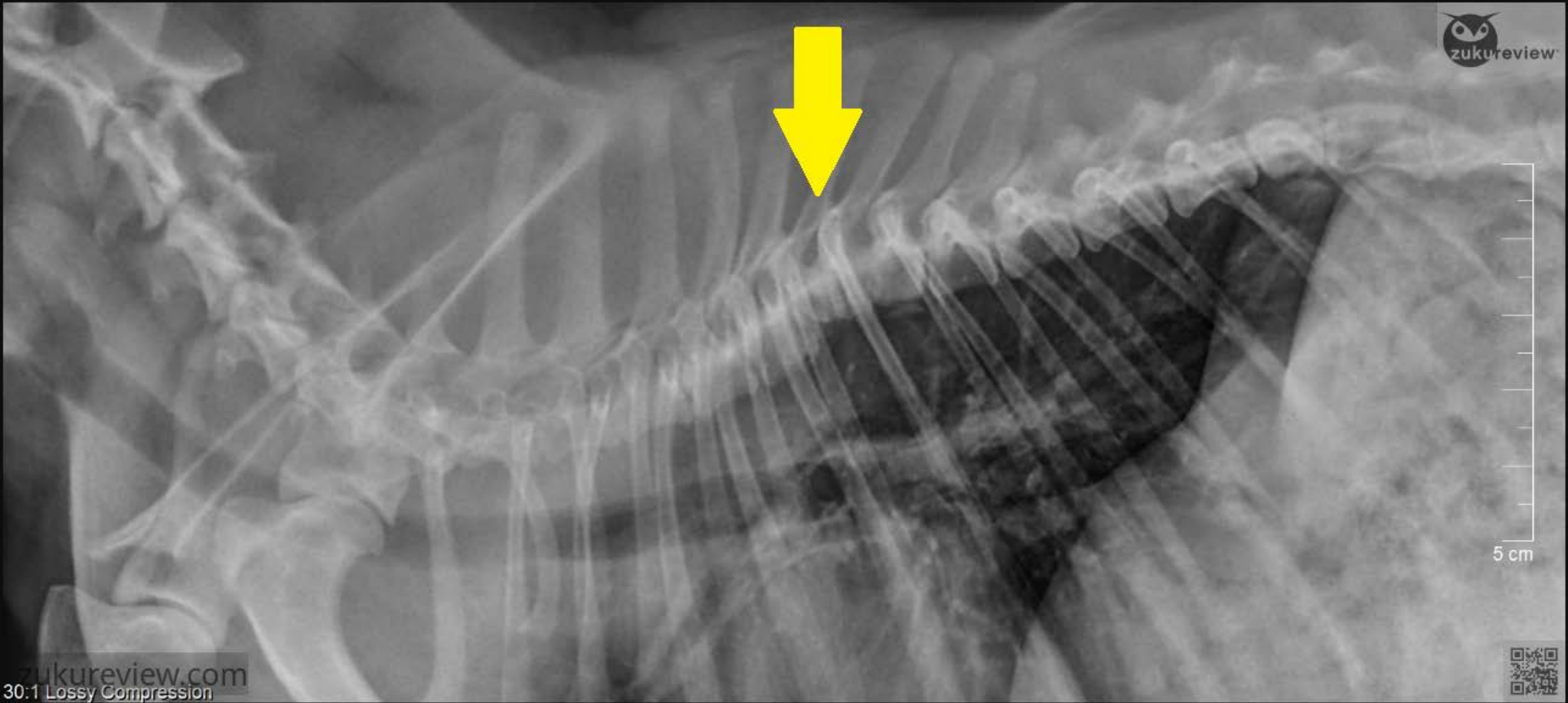
T3-L3 in

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With what structure is there a problem in this 10-year-old fox terrier?



Esophagus	HIDE
Scapula	HIDE
Dorsal spinous process	HIDE
Tympanic bulla	HIDE
Trachea	HIDE

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Tympanic bulla	HIDE
Trachea	HIDE

PREV

21 22 23 24 25 26 27 28 29 30

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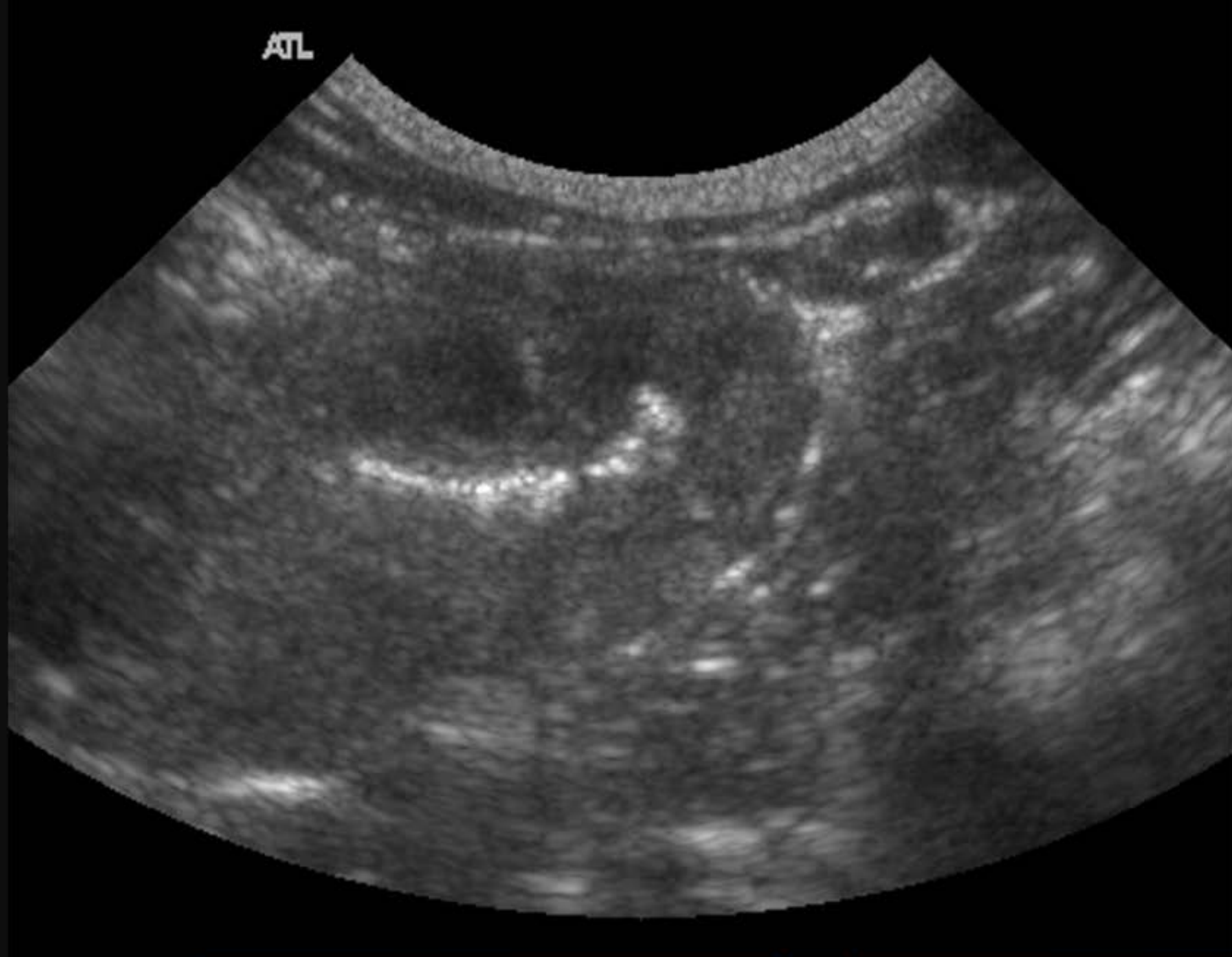
With wha



**Correct:**  
The mass is associated with the **esophagus**. There is an **oval mass dorsal to the trachea in the cranial neck**.  
It **extends** from **C2 to C5**. There is an irregular gas lucency through the mid-area of the mass, and the caudal aspect is also outlined by gas in the esophageal lumen.  
Click here to see an [ultrasound image](#) of this mass. On sagittal and transverse ultrasound images, the mass is homogeneous with an irregular gas pattern that is contiguous with the esophageal lumen.  
The mass is an expansion of the esophageal wall. This was an extramedullary plasmacytoma.  
Click here to see [normal canine cervical radiographs](#).

Esophag	
Scapula	HIDE
Dorsal spinous process	HIDE
Tympanic bulla	HIDE
Trachea	HIDE





# IMAGING ANATOMY

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## Canine Cervical Spine Example 3

The following radiographs are the right lateral and ventrodorsal views of the cervical spine of an eight-year-old Cairn Terrier.





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A 13-year-old German shepherd is presented with a complaint of weight loss over three months.

Over the last 7 days the owner reports vomiting, diarrhea, lethargy, inappetence, decreased drinking, and straining to defecate and urinate. Radiographs suggest a mass in the abdomen.

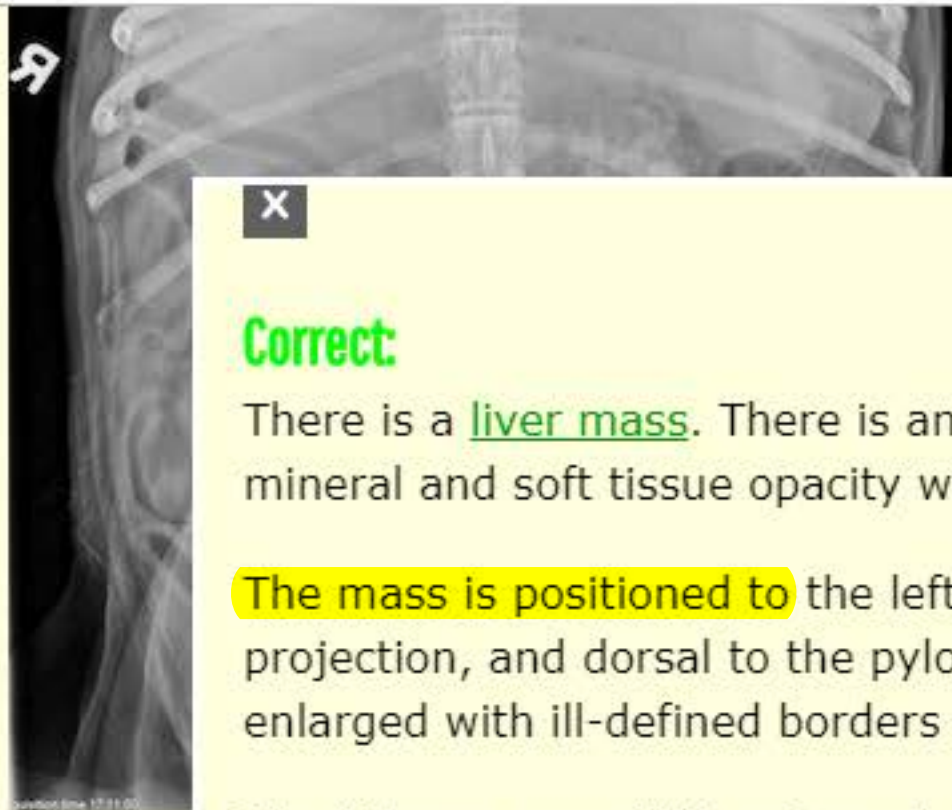
Which one of the following structures does it primarily involve?





Left kidney	HIDE
Mesenteric lymph nodes	HIDE
Liver	HIDE
Spleen	HIDE
Pylorus	HIDE





Correct

There is a liver mass. There is an ill-defined, rounded region of heterogeneous mineral and soft tissue opacity within the cranial abdomen near midline.

The mass is positioned to the left of midline, cranial to the left kidney on the v/d projection, and dorsal to the pylorus on the right lateral projection. The liver appears enlarged with ill-defined borders on both views.

The kidneys are mildly enlarged. A urinary catheter is present which terminates at the apex of the urinary bladder.

There are large, rounded soft tissue masses on the perineum and prepuce. There is mild multifocal spondylosis deformans which is worse at the L-S space.

Left kidney

Mesenteric

Liver

Spleen

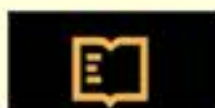
HIDE

Pylorus

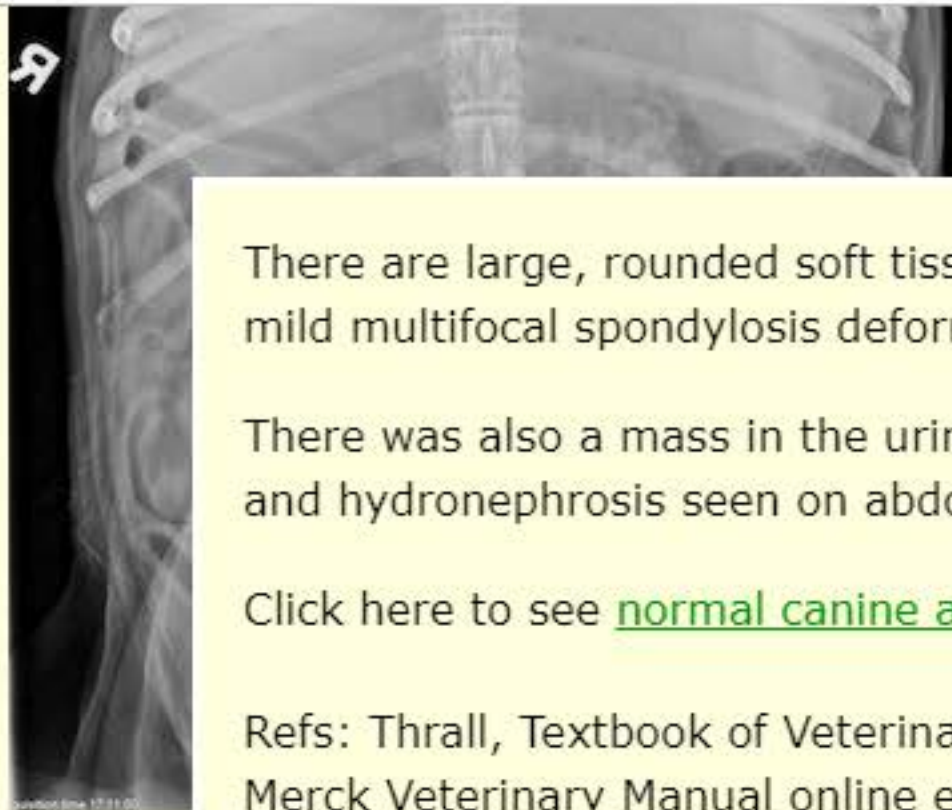
HIDE

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There are large, rounded soft tissue masses on the perineum and prepuce. There is mild multifocal spondylosis deformans which is worse at the L-S space.

There was also a mass in the urinary bladder causing bilateral ureteral obstruction and hydronephrosis seen on abdominal ultrasound.

Click here to see [normal canine abdominal radiographs](#).

Refs: Thrall, Textbook of Veterinary Diagnostic Radiology 6<sup>th</sup> ed. pp. 683-4 and the Merck Veterinary Manual online edition. Radiographic interpretation and images courtesy, Dr A. Zwingenberger and [Veterinary Radiology](#). Normal radiograph links courtesy, [Imaging Anatomy](#) Univ. of Illinois Vet Med.

Left kidney

Mesenteric

Liver

Spleen

HIDE

Pylorus

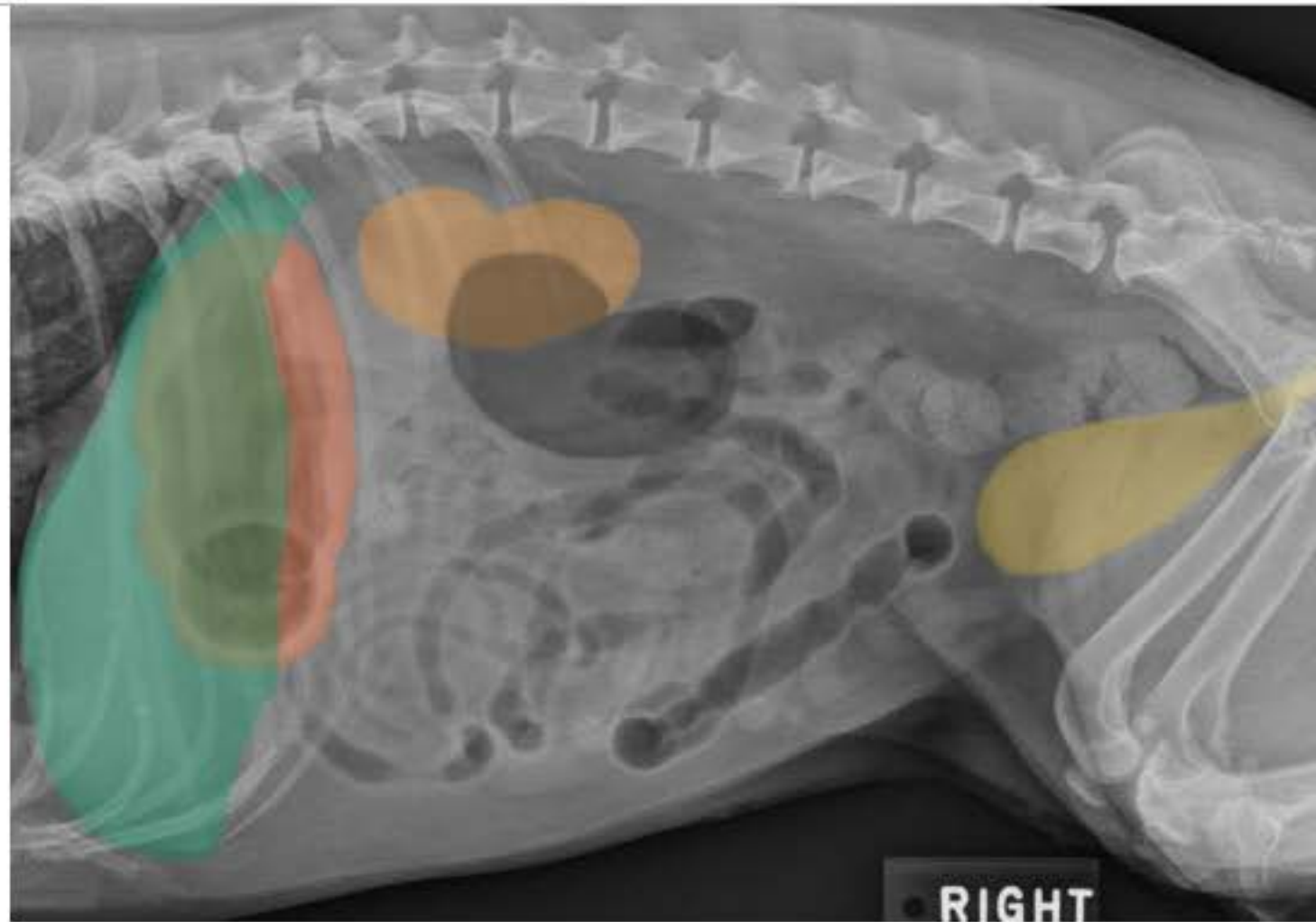
HIDE

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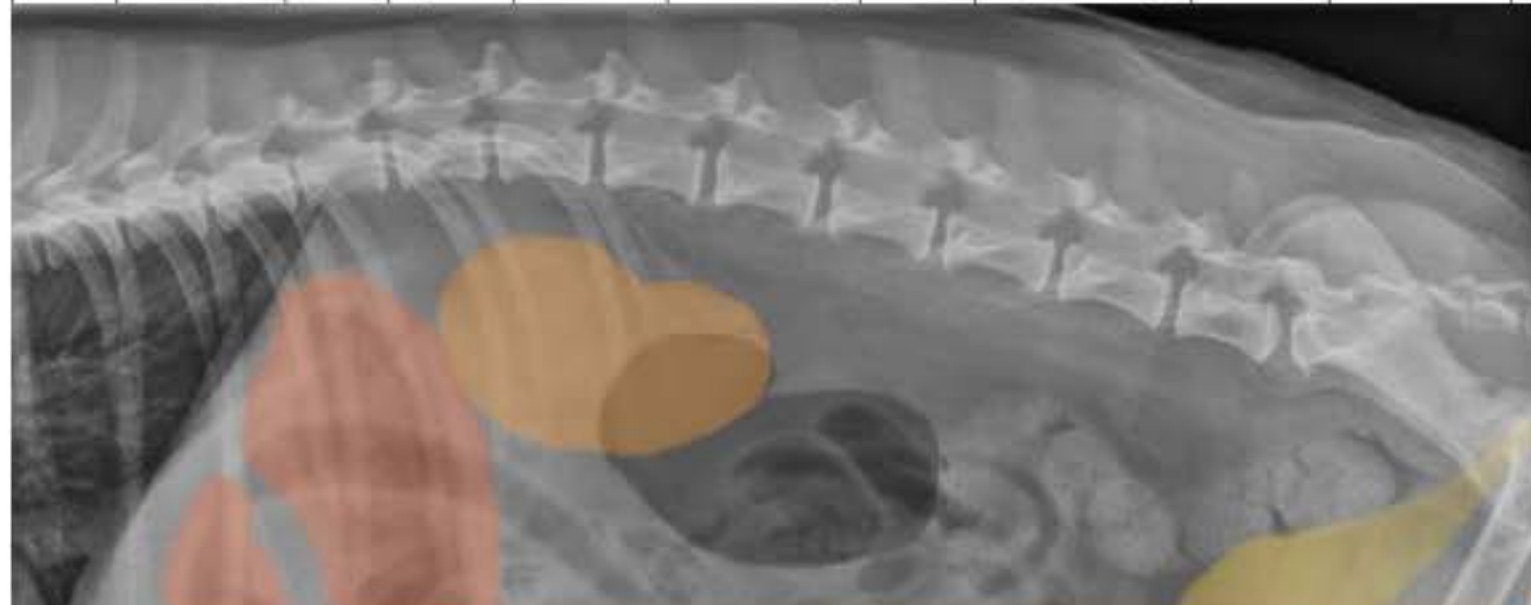
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Plain All Layers Liver Spleen Stomach Left Kidney Colon Right Kidney Bladder Duodenum



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Abdominal ultrasound of a dachshund reveals bilaterally enlarged adrenal glands (an example of one of the images is shown below).

What clinical signs would you expect to see in a dog with these findings?

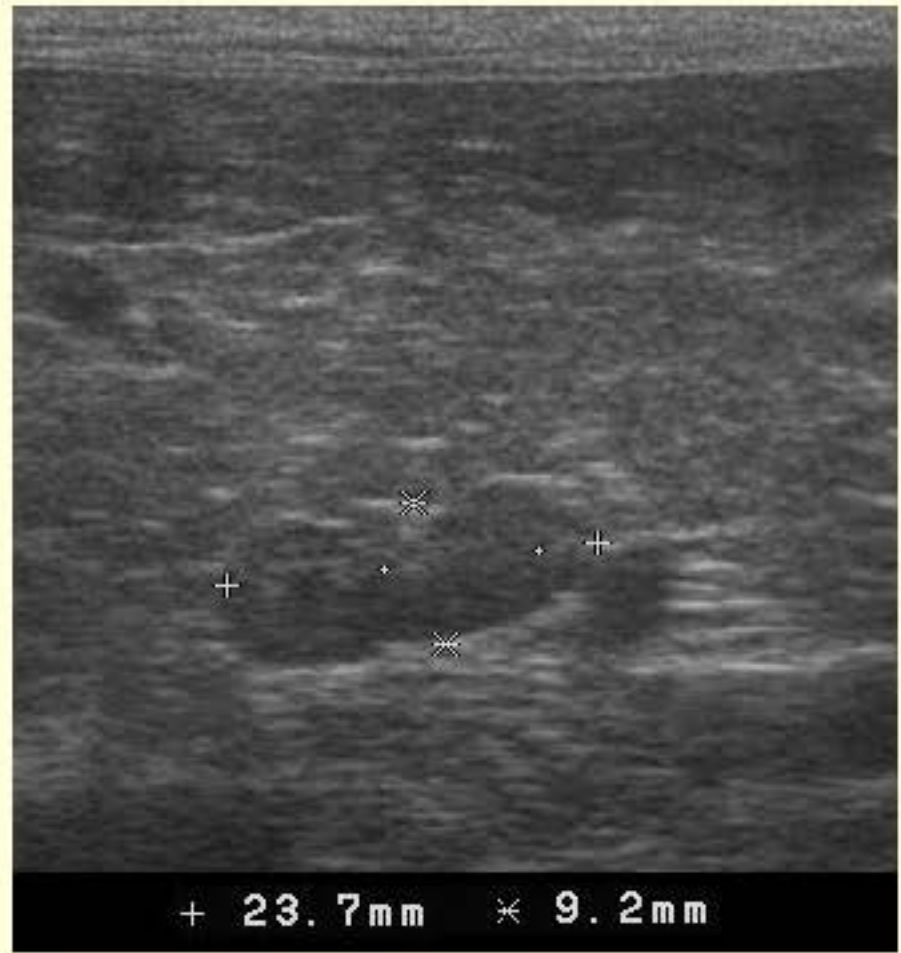


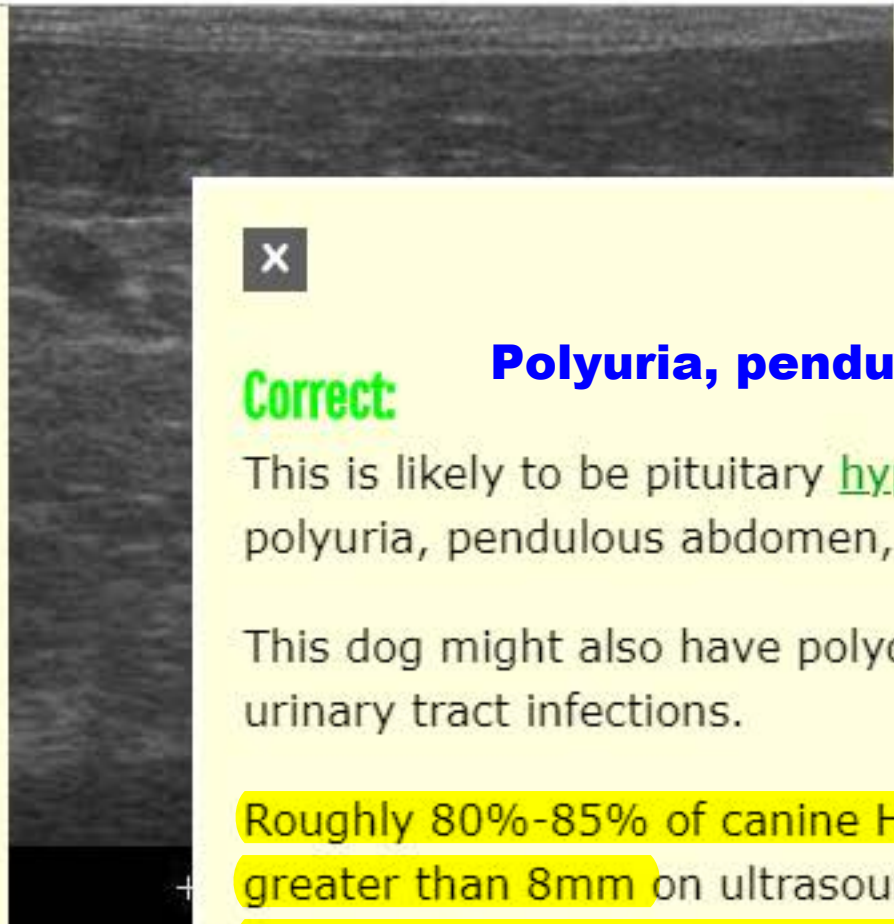
Image courtesy, Dr Kalumet.





Image courtesy, Dr Kalumet.

Lethargy, tragic facial expression, tail alopecia	HIDE
Pruritis, alopecia of lower back, cold intolerance	HIDE
Polydipsia, seizures, watery diarrhea	HIDE
Polyuria, pendulous abdomen, truncal alopecia	HIDE
Gastroenteritis, bradycardia, exercise intolerance	HIDE



### Polyuria, pendulous abdomen, truncal alopecia

Correct:

This is likely to be pituitary hyperadrenocorticism (HAC). Signs might include polyuria, pendulous abdomen, truncal alopecia.

This dog might also have polydipsia, polyphagia, muscle weakness, and recurrent urinary tract infections.

Roughly 80%-85% of canine HAC cases are pituitary-expect bilateral enlargement greater than 8mm on ultrasound.

Roughly 15%-20% of canine HAC cases are adrenal-expect unilateral adrenal enlargement greater than 8mm, with possible atrophy in the contralateral gland.

Lethargy You can also see unilateral adrenomegaly with an incidental. nonfunctional adrenal

Pruritis, alopecia of lower back, cold intolerance

HIDE

Polydipsia, seizures, watery diarrhea

HIDE

Polyuria, pendulous abdomen, truncal alopecia

HIDE

Gastroenteritis, bradycardia, exercise intolerance

HIDE

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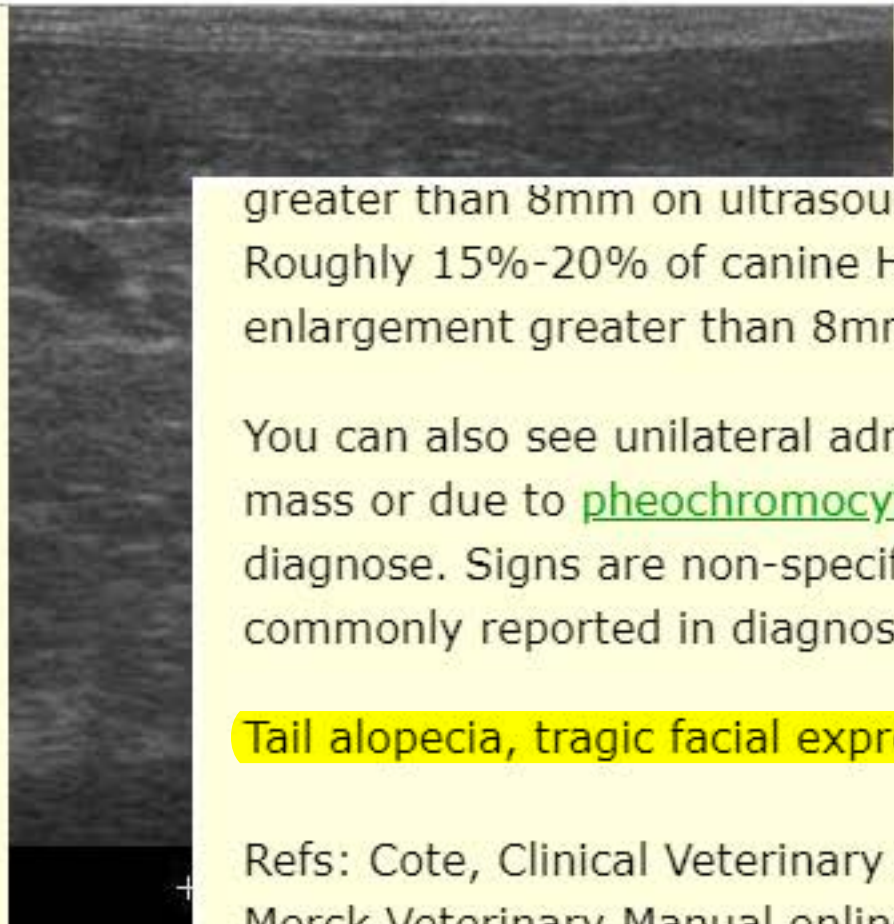


Image courtesy of Dr. Kalumet.

greater than 8mm on ultrasound.  
Roughly 15%-20% of canine HAC cases are adrenal-expected unilateral adrenal enlargement greater than 8mm, with possible atrophy in the contralateral gland.

You can also see unilateral adrenomegaly with an incidental, nonfunctional adrenal mass or due to [pheochromocytoma](#). This disease is relatively rare and difficult to diagnose. Signs are non-specific, but intermittent weakness and collapse are commonly reported in diagnosed case-patients.

Tail alopecia, tragic facial expression, and lethargy are signs of [hypothyroidism](#).

Refs: Cote, Clinical Veterinary Advisor-Dogs and Cats, 3<sup>rd</sup> ed. pp. 525-7 and the Merck Veterinary Manual online edition. Image courtesy, [Dr Kalumet](#).

Lethargy

Pruritis, alopecia of lower back, cold intolerance

HIDE

Polydipsia, seizures, watery diarrhea

HIDE

Polyuria, pendulous abdomen, truncal alopecia

HIDE

Gastroenteritis, bradycardia, exercise intolerance

HIDE

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What is purpose of the **collimator in** x-ray machine?

Provides electricity needed to heat the filament	HIDE
Decreases production of scatter radiation	HIDE
Prevents beta radiation from reaching the film	HIDE
Maintains a vacuum environment	HIDE
Removes less-energetic x-ray from primary beam	HIDE

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**Correct:**

A collimator is a beam-restricting device that decreases production of scatter radiation.

This improves radiation safety to personnel (less exposure) and improves image quality.

Provides

Glass and aluminum filters removing less-energetic x-ray from primary beam.

Decreases

Low voltage electrical circuits provide electricity needed to heat the filament.

Prevents

Refs: Tighe & Brown, Mosby's Comprehensive Review for Vet Techs, 2<sup>nd</sup> ed. p. 176 and Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. p. 545.

Removes

less energetic x-ray from primary beam

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A 5-year-old female DSH cat is presented with a history of anorexia and lethargy over the past month. She is 5-7 percent dehydrated.

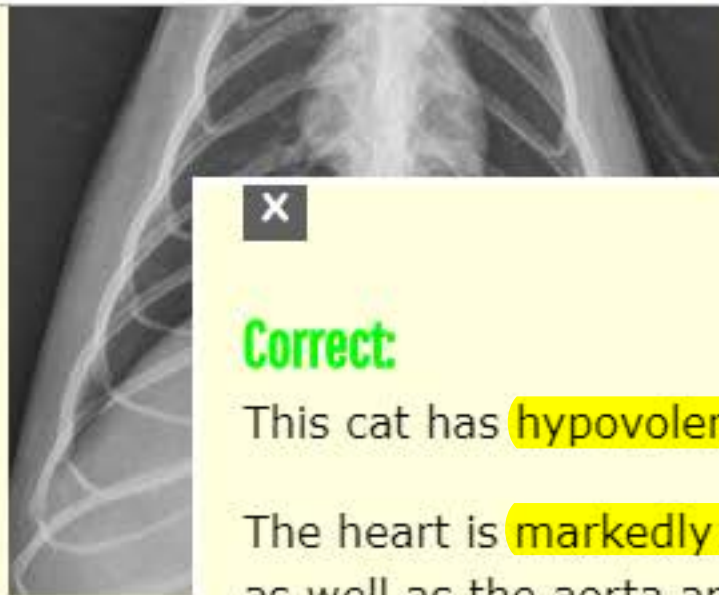
Which one of the following choices is apparent from these thoracic radiographs?







Hypertrophic cardiomyopathy	HIDE
Normal radiographs	HIDE
Allergic pneumonitis	HIDE
Heartworm disease	HIDE
Hypovolemia	HIDE



**Correct:**

This cat has **hypovolemia** secondary to hepatic lipidosis.

The heart is **markedly small and lifted off of the sternum**. The pulmonary vasculature as well as the aorta and caudal vena cava are also reduced in size.

The pulmonary structures appear within normal limits. Within the viewable abdomen the liver appears enlarged, extending past the costochondral arches.

When circulating blood volume is reduced through blood loss, dehydration, or shock, the cardiac and vascular structures in the thorax can appear small on radiographs.

In this case, the heart is small, giving the appearance of *lifting* from the sternum.

Hypertro

Normal

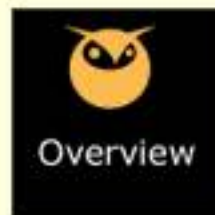
Allergic

Heartwo

Hypovol

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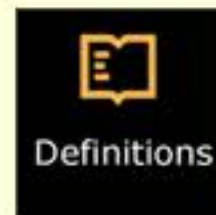
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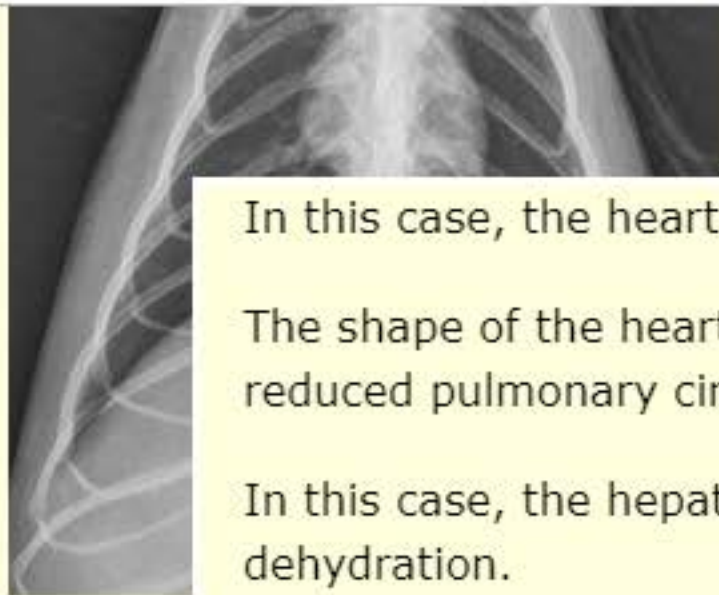


Definitions



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In this case, the heart is small, giving the appearance of *lifting* from the sternum.

The shape of the heart is also often more angular, and less rounded than usual. The reduced pulmonary circulation also makes the lungs appear more lucent.

In this case, the hepatic lipidosis was the primary disease with secondary dehydration.

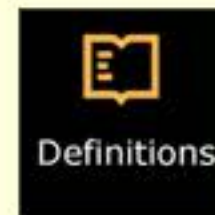
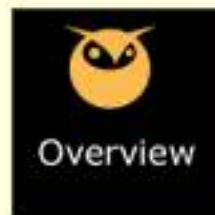
Click here to see [normal feline thoracic radiographs](#).

Refs: Cote, Clinical Veterinary Advisor-Dogs and Cats, 3<sup>rd</sup> ed. pp. 263-4 and the Merck Veterinary Manual online edition. Radiographic interpretation and images courtesy, Dr A. Zwingenberger and [Veterinary Radiology](#).

- Hypertro
- Normal
- Allergic
- Heartwo
- Hypovol

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What is the main reason for clipping hair before an ultrasound procedure?

To increase beam absorption	HIDE
To decrease sound reflection	HIDE
To avoid damage to the transducer	HIDE
To decrease scattering	HIDE
To increase sound refraction	HIDE

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What is t  
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To decre  
To avoid  
To decre

**Correct: To decrease sound reflection**

Hair traps air, which is a major cause of ultrasound reflection.

Ultrasound waves reflected by hair do not enter the animal and result in poor image quality.

Clipping hair from the area of an ultrasound examination and cleaning dirt from the skin will greatly increase the quality of ultrasound image.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 552-3.

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What does an **overexposed radiograph** look like?

Transparent	HIDE
Very dark	HIDE
Foggy	HIDE
Very white	HIDE
Speckled	HIDE

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What do

Transpa

Very da

Foggy

Very wh

Speckle

**Correct:**

An overexposed radiograph has had too much exposure to x-rays, and it will be **DARKER.**

Remember that the patient's body stops some x-rays from penetrating all the way to the x-ray film, which lies UNDER the patient.

Wherever the body is, the underlying film is whiter, more pale, lighter.

Wherever there is no body in the way, the radiograph will be very dark or black, **because** the x-rays penetrate and expose the film without any tissues to stop them.

For good tables that list common technical errors in taking and developing x-ray films, see Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 541-2, boxes 16-2 and 16-3.

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Which choice correctly includes the key components of an x-ray exposure?

Grid scatter; rotor speed; angle of tungsten target	HIDE
Focal-film distance; milliamperere-seconds; kilovoltage	HIDE
Potter-Bucky diaphragm; cassette thickness; tissue density	HIDE
Filament temperature; photon dispersion; exposure time	HIDE

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- Which of the following is NOT a component of an x-ray exposure?
- Grid scale
  - Focal-film distance
  - Potter-Bucky factor
  - Filament current

Correct:

The key components of an x-ray exposure are focal-film distance, milliamperere-seconds (mAs) and kilovoltage (kVp).

Kilovoltage (kVp) controls the penetrating ability of an x-ray. The kVp also affects the scale of contrast. Using a lower kVp will produce a higher-contrast image. Increasing kVp increases radiographic density (film blackness).

Milliamperes (mA) are the QUANTITY of electrons produced by the x-ray machine and exposure time (sec) is how LONG you expose the animal to these rays.

Together, milliamperere-seconds equals mA multiplied by time (mA X sec=mAs), which controls the intensity of an x-ray.

More mA, or longer exposure time, means a DARKER x-ray.

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What is the principal disadvantage of using a grid while taking a radiograph?

A grid will increase the amount of scattered radiation	HIDE
Decreased resolution	HIDE
Visible gridlines distort the radiograph	HIDE
Longer exposure time required	HIDE
Cannot use with body parts over 10 cm thick	HIDE

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21

What is t

A grid w

Decreas

Visible g

Longer

Cannot use with body parts over 10 cm thick

The principal disadvantage is that grids require a longer exposure time to obtain a given film density.

A grid is like the focusing lens in a camera.

The grid prevents scattered radiation from reaching an x-ray film, so that only the primary, directly aimed x-rays penetrate straight into the animal for the best image.

Use of a grid results in some absorption of the primary beam. A longer exposure time is necessary to compensate for the reduced radiation reaching the film.

Thick body parts like thorax, abdomen, skull and joints greater than 10 cm require a grid.

Gridlines are visible but do NOT distort an image. In fact you get a HIGHER resolution image when using a grid.

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21	✓	22	✗	23	✓	24	✓	25	✓	26	M	✓	27	✓	28	✓	29	✓	30
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Which ultrasound display mode shows returning echoes as peaks?

B-mode	HIDE
C-mode	HIDE
A-mode	HIDE
S-mode	HIDE
M-mode	HIDE

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21

Which ul

- B-mode
- C-mode
- A-mode**
- S-mode
- M-mode

**Correct:**

**A-mode**, (or amplitude mode), is a one-dimensional display, which shows returning echoes as spikes onscreen. The intensity of echo is displayed by the height of the peak.

**B-mode**, or brightness mode, is two-dimensional imaging.

In **M-mode** ultrasonography the motion of the organs is displayed as a wavy line across the screen.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 553-4 and Tighe & Brown, Mosby's Comprehensive Review for Vet Techs, 3<sup>rd</sup> ed. p. 197.

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At what day post-ovulation is it first possible to see the fetal heart beat of an equine pregnancy on ultrasound?

Day 25	HIDE
Day 16	HIDE
Day 45	HIDE
After day 100	HIDE
Day 9	HIDE

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**31** **M**

At what  
pregnan

At what  
pregnan

Day 25

Day 16

Day 45

After da

Day 9

Day 9

Day 9

Day 9

Day 9

Day 9

Day 9

Day 9

Day 9

Day 9

Day 9

Day 9

**Correct:**

The equine fetal **heart beat** is ultrasonographically **apparent by day 25.**

Click here to see a labeled ultrasound of a [24-day conceptus](#).

Click here and scroll down to see a video of a [30-day conceptus showing the heart beat](#).

Merck has a nice overview of [diagnosing equine pregnancy](#).

The **equine embryo** can first be **seen** via **transrectal ultrasound** at **day 9-10**, it would be **~4 mm in** diameter.

**Often the first ultrasound to determine pregnancy** is performed at day **14-18.**

Click here to see an ultrasound showing a [13-day embryo](#).

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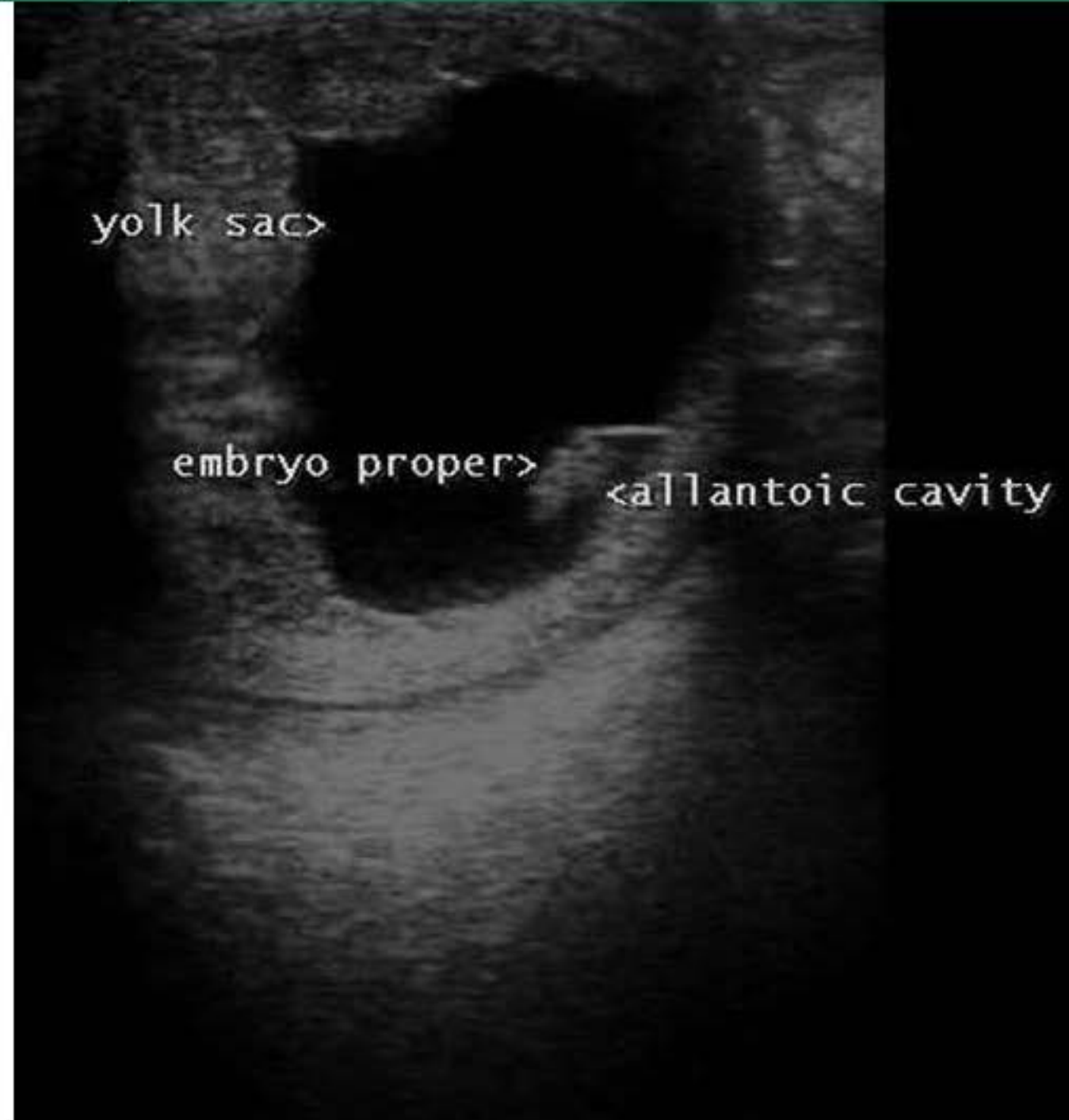
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Courtesy of Dr. Patricia Sertich.

At 24 days, the allantoic cavity (small anechoic space) is first visible just ventral to the embryo proper. The yolk sac is the large anechoic space seen dorsally.



Sonogram of 13-day conceptus, mare



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31 <sup>M</sup>	32	33	34	35	36	37	38	39	40
-----------------	----	----	----	----	----	----	----	----	----

Which of the following choices is synonymous with **sonolucent?** (Dark on ultrasound)

Hyperechoic	HIDE
Anechoic	HIDE
Sonotropic	HIDE
Radiodense	HIDE
Echoic	HIDE

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PREV

31M

Which of

Radiode

Echoic

Anechoi

Sonotro

Hyperechoic

Correct:

Anechoic or sonolucent structures produce few or no echoes. Both are DARK on ultrasound.

Echogenic or sonodense structures produce strong echoes, so these are bright on the ultrasonic image.

Hyperechoic structures produce more echoes than nearby structures.

Hypoechoic structures produces fewer echoes than nearby structures.

Refs: Tighe & Brown, Mosby's Comprehensive Review for Vet Techs, 3<sup>rd</sup> ed. p. 197.

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Which one of the following artifacts is caused by an **uneven distribution of photons**, resulting in **an increase in intensity of the x-ray beam on the cathode side of the x-ray tube?**

Ghost image	HIDE
Elongation	HIDE
Foreshortening	HIDE
Gridlines	HIDE
Heel effect	HIDE

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31M

- Which or
- in an inc
- Ghost in
- Elongati
- Foresho
- Gridline:

Correct:

The heel effect is due to an uneven distribution of photons leaving the x-ray tube.

This causes the x-ray beam to be more intense at the cathode side compared to the anode side.

The variation in intensity is related to the angle of the tungsten target and its absorption of photons.

The result is a darker image on the cathode side of the image.

To create a uniform density across the image, position the thicker portion of the anatomic structure being radiographed towards the cathode side of the x-ray tube.

Click here to see a YouTube video describing the heel effect.



Heel effect

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 **31** 

Which of the following is an inc

- Ghost in
- Elongati
- Foresho
- Gridline:

**Foreshortening** occurs when the structure being radiographed is lifted off the table, causing the structure to appear shorter than its actual size.

**Elongation artifact** occurs when the x-ray beam is not centered on the structure being radiographed, causing the image to appear longer than its normal size.

**Gridlines** occur if the lead strips in the grid are too thick, causing them to appear in the image.

Click to see examples of [several radiographic artifacts](#) from The Ohio State University's website.

Refs: McCurnin and Bassert, Clinical Textbook for Veterinary Technicians, 9<sup>th</sup> ed. pp. 480-499.

Heel effect HIDE

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31  	32  	33 	34	35	36	37	38	39	40
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Which one of the following **systems** is primarily **diseased** in these images from a 4-year-old Springer spaniel?





Diaphragm	HIDE
Spinal	HIDE
Cardiac	HIDE
Skeletal	HIDE
Pulmonary	HIDE





**Correct:**

The disease involves **the pulmonary system**. There is a **diffuse bronchial pattern** and bronchiectasis demonstrated by poorly tapering airways.

There is increased soft tissue opacity dorsal to the carina, as well as a patchy alveolar pattern in the left cranial, left caudal, and right caudal lung lobes. The cardiovascular structures are within normal limits.

This is suggestive of chronic lower airway disease. The patchy alveolar pattern may be caused by extension of inflammatory disease, or mucus plugging with underlying pneumonia.

This dog has [eosinophilic bronchopneumopathy](#).

Click here to see [normal canine thoracic radiographs](#).

- Diaphrag
- Spinal
- Cardiac
- Skeletal
- Pulmona**

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31 <small>M</small> 	32 <small>M</small> 	33 	34 	35	36	37	38	39	40
---	---	--	--	----	----	----	----	----	----

Which one of the following choices is the preferred imaging modality for the brain and spinal cord?

Magnetic resonance imaging	HIDE
Diagnostic nuclear medicine	HIDE
Contrast computed tomography	HIDE
Radiography	HIDE
Ultrasonography	HIDE

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31M

Which or  
cord?

- Magneti
- Diagnos
- Contrast
- Radiogra

Ultrasonography HIDE

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Magnetic resonance imaging (MRI) is the preferred imaging modality for the brain and spinal cord.

With MRI, a radiofrequency pulse disrupts hydrogen nuclei within tissues.

The intensity of the radio wave signal produced from this disruption creates the image.

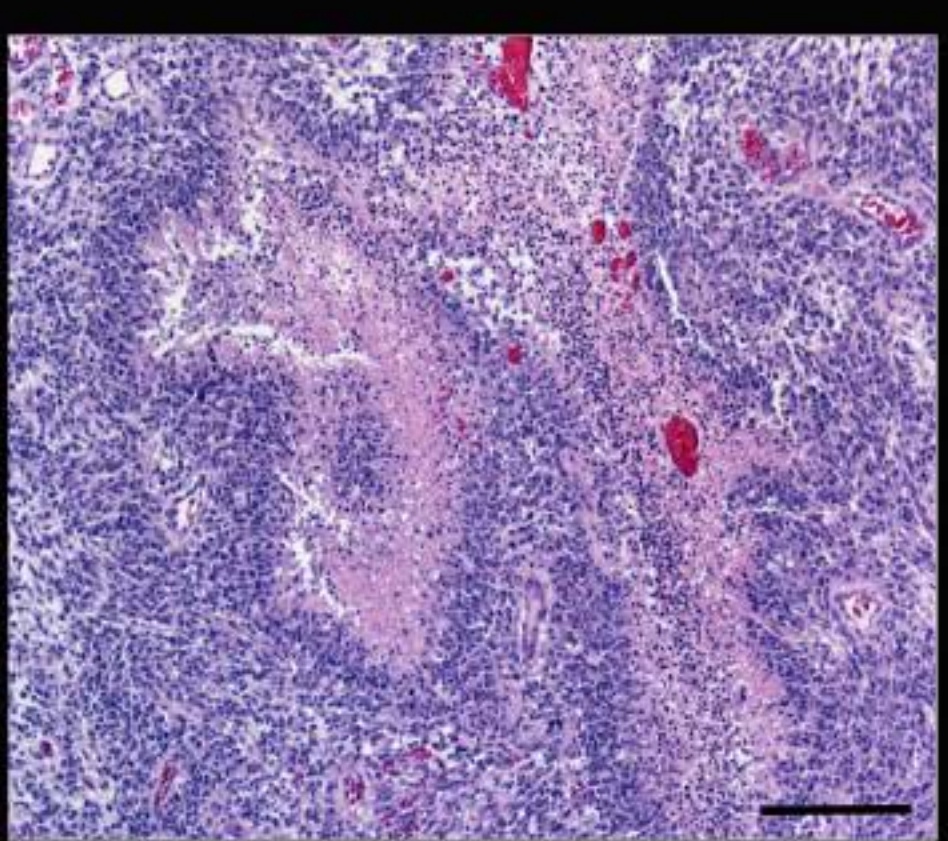
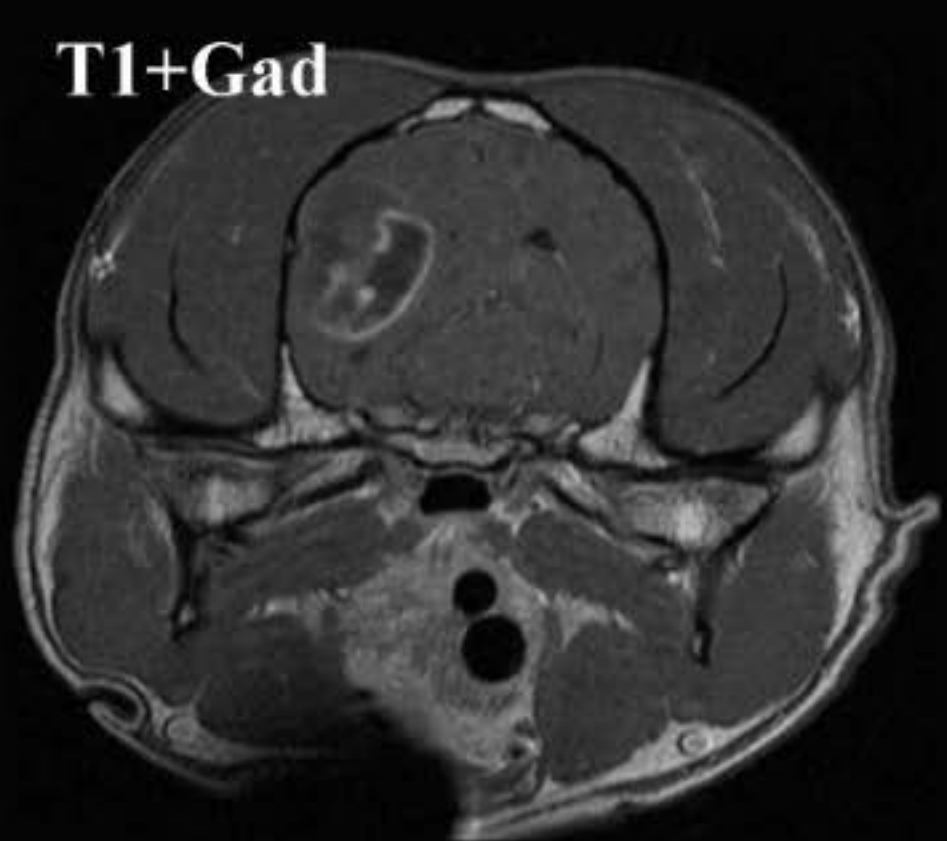
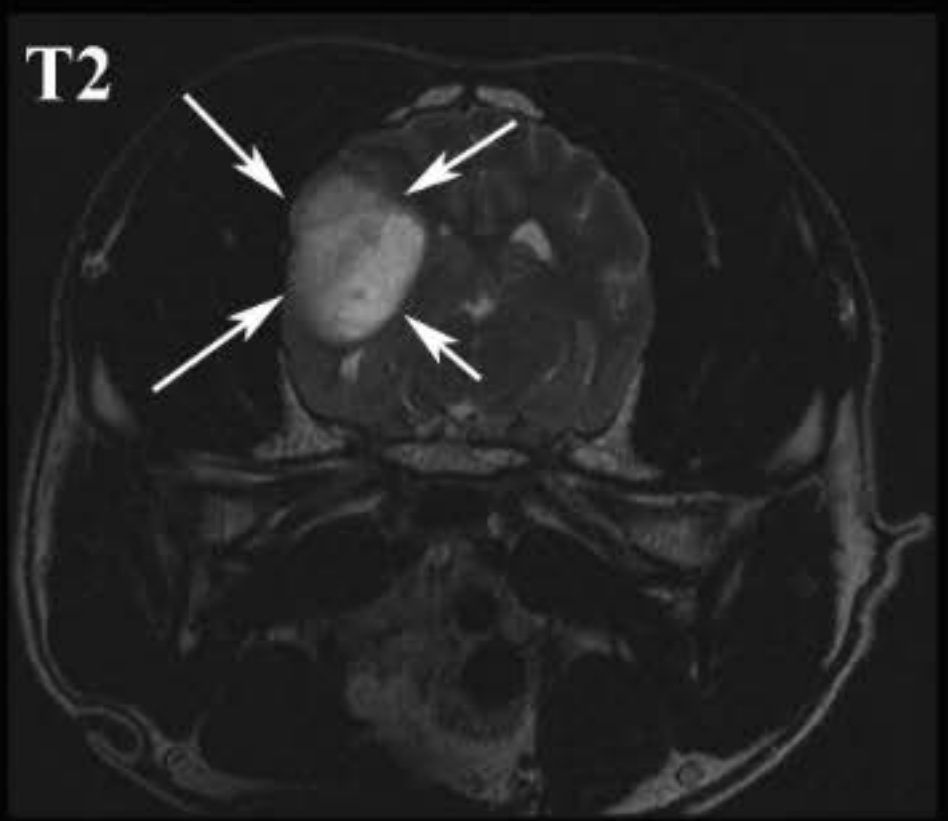
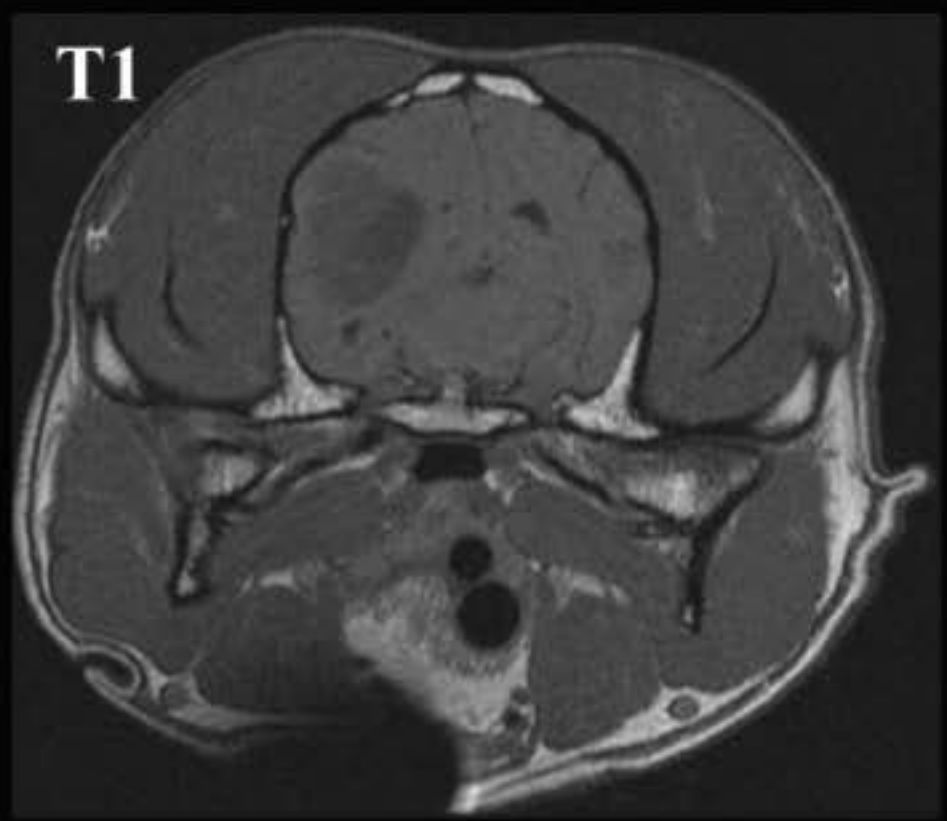
Like computed tomography (CT), MRI provides a cross-sectional image of the patient's anatomy.

However, unlike CT, no ionizing radiation is used to create the image.

Also, MRI provides superior image resolution and anatomic definition compared to CT.

Click here to see [MRI images of a dog with a brain tumor.](#)







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31 <sup>M</sup> ✖	32 <sup>M</sup> ✔	33 ✔	34 ✔	35 ✔	36	37	38	39	40
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A 4 year old outdoor male neutered cat is presented with a history of anorexia and thin body condition.

Which one of the following areas is most affected in these radiographs?

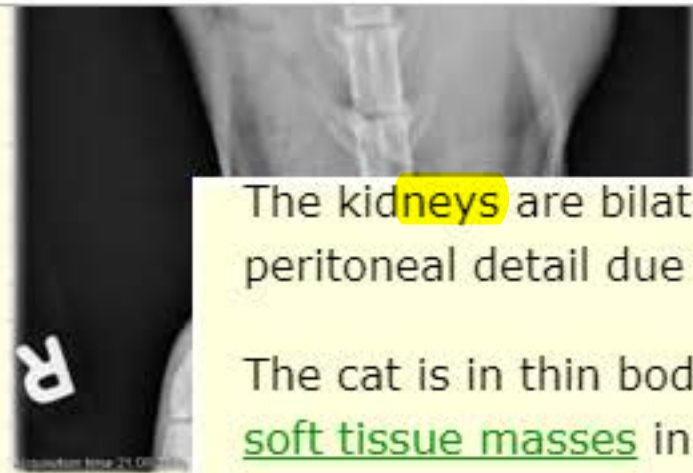




Images courtesy, [Veterinary Radiology](#).

Peritoneal space	HIDE
Uterus	HIDE
Kidneys	HIDE
Colon	HIDE
Mesenteric lymph nodes	HIDE





Images

Peritone

Uterus

Kidneys

Colon

Mesente

The kidneys are bilaterally enlarged. On the images of the abdomen, there is poor peritoneal detail due to a mid abdominal mass effect.

The cat is in thin body condition, also contributing to poor detail. There are two oval soft tissue masses in the region of the kidneys.

They are displacing the colon ventrally on the lateral projection, and medially on the v/d projection. There is possible mineralization in the left kidney.

The kidneys are markedly enlarged and irregular in shape. The other abdominal organs are displaced peripherally.

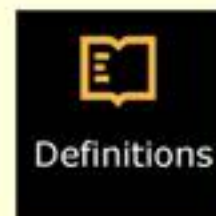
The spleen appears enlarged.

The cat was diagnosed with renal lymphoma.

Click here to see normal feline abdominal radiographs.

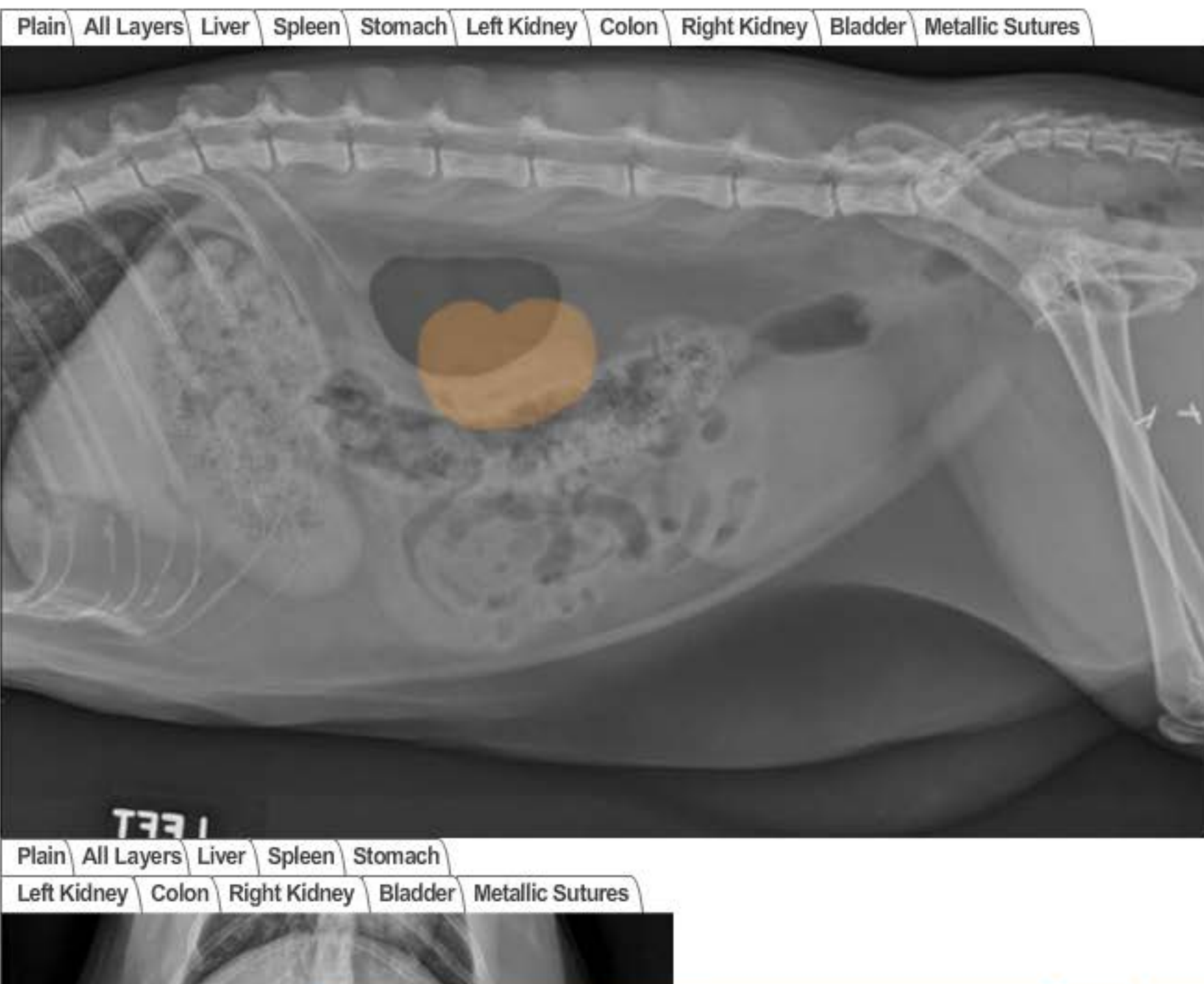
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# Feline Abdomen Example 1

The following radiographs are the left lateral and ventrodorsal views of the abdomen of a four-year-old Domestic Shorthair. Two metallic hemoclips are present ventral to the pelvis, they may correspond to previous castration.





**zukureview**

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31 <sup>M</sup> ✕	32 <sup>M</sup> ✓	33 ✓	34 ✓	35 ✓	36 ✕	37	38	39	40
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Ionizing radiation is used to create an image in radiography.

Which one of the following choices lists another diagnostic modality that uses ionizing radiation?

Hyperbaric oxygen therapy	HIDE
Bronchoscopy	HIDE
Ultrasonography	HIDE
Computed tomography	HIDE
Magnetic resonance imaging	HIDE

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PREV

31M

Ionizing

Which or  
radiation

Hyperba

Broncho

Ultrason

Correct:

In computed tomography (CT), ionizing radiation is used to create an image.

During a CT scan, an x-ray beam passes transaxially through the patient.

X-ray attenuation (drop off) is measured at sequential sites in a segment of the patient's anatomy.

A computer reconstructs the data into a cross-sectional image viewed on a monitor.

Computed tomography provides better spatial resolution and radiographic contrast compared to standard radiography.

Computed tomography	HIDE
Magnetic resonance imaging	HIDE

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- Ionizing
- Which or radiation
- Hyperba
- Broncho
- Ultrason

Computed tomography provides better spatial resolution and radiographic contrast compared to standard radiography.

Patients must remain still for a long period of time, necessitating heavy sedation or general anesthesia to achieve proper positioning without motion artifact.

Therefore, CT may be too risky in unstable patients.

Click here to see a [CT image of a lung lobe torsion in a dog](#) (scroll down).

Refs: McCurnin and Bassert, Clinical Textbook for Veterinary Technicians, 9<sup>th</sup> ed. pp. 515-7, U of Penn Veterinary School and Merck Veterinary Manual online edition.

Computed tomography	HIDE
Magnetic resonance imaging	HIDE

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What is the primary abnormality in these thoracic radiographs of a 5-year-old Siamese cat?

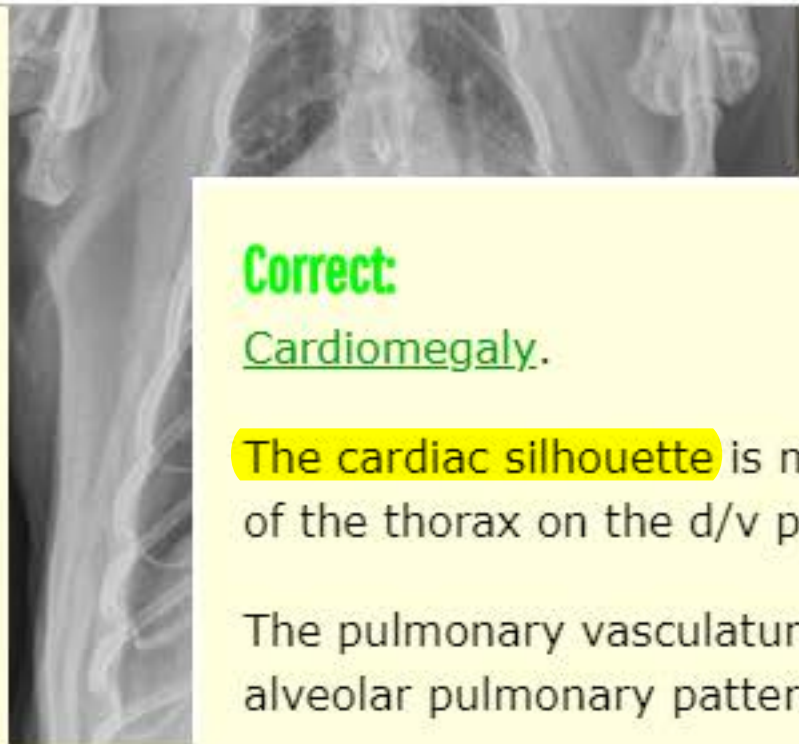






Images courtesy, [Veterinary Radiology](#).

Interstitial pattern	HIDE
Alveolar pattern	HIDE
Cardiomegaly	HIDE
Enlarged, tortuous pulmonary vasculature	HIDE
Mediastinal mass	HIDE



**Correct:**

Cardiomegaly.

The cardiac silhouette is markedly enlarged and rounded, occupying the entire width of the thorax on the d/v projection.

The pulmonary vasculature is normal in size, and there is no evidence of interstitial or alveolar pulmonary pattern.

The pleural space and mediastinum are normal. Differentials would include cardiomyopathy or pericardial effusion.

Echocardiography revealed dilated cardiomyopathy.

Click here to see [normal feline thoracicradiographs](#).

Images c

Interstit

Alveolar

Cardiomegaly

HIDE

Enlarged, tortuous pulmonary vasculature

HIDE

Mediastinal mass

HIDE

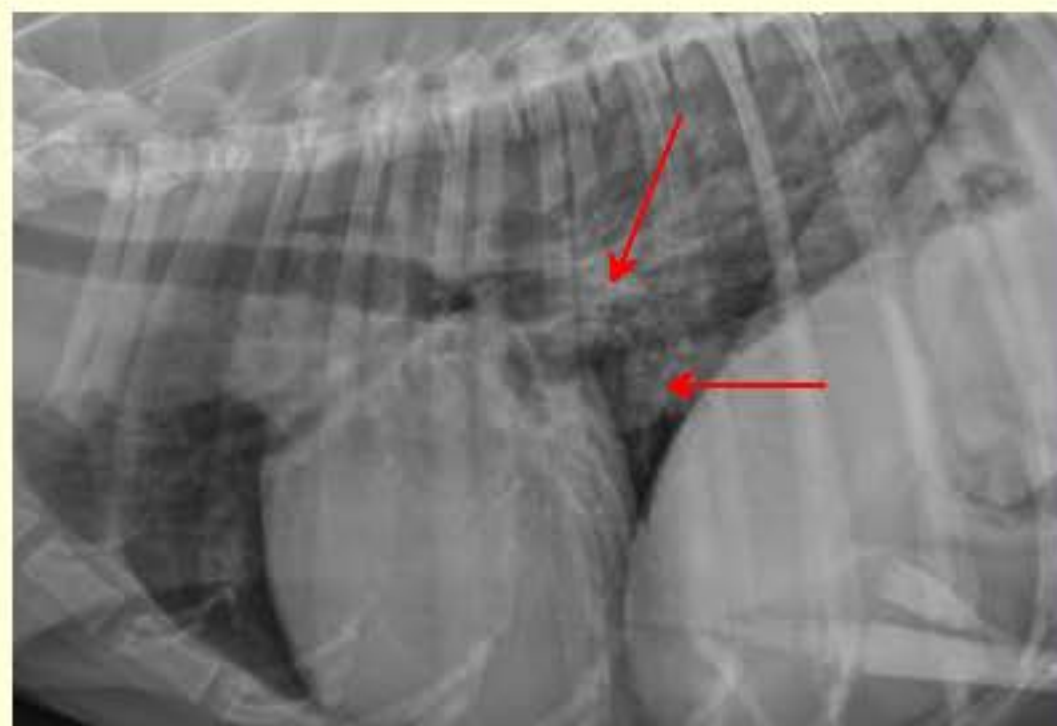
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31 <sup>M</sup>	32 <sup>M</sup>	33	34	35	36	37	38	39	40
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What is indicated by the arrows in the radiograph seen below?



Air bronchograms	HIDE
Pleural fissure lines	HIDE
Miliary pattern	HIDE
Hilar lymphadenopathy	HIDE
End-on bronchioles	HIDE

31 <sup>M</sup>	32 <sup>M</sup>	33	34	35	36	37	38	39	40
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What is i



**Correct:**  
The two small circles indicated by arrows are **end-on bronchioles**.  
They are commonly seen in the **hilar region** and they are normal there, unless there is abnormal thickening of bronchiole walls.  
Don't confuse a few of these with **bronchial lung pattern**, characterized by irregularly thickened walls of bronchioles that look like "donuts" or "cygnet rings" end-on or "tram tracks" side-on.  
For an excellent visual **summary of bronchial pattern**, see Dr. Allison Zwingenberger's Vet Radiology site.

Air bron	
Pleural fissure lines	HIDE
Miliary pattern	HIDE
Hilar lymphadenopathy	HIDE
End-on bronchioles	HIDE



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31 <sup>M</sup> ✗	32 <sup>M</sup> ✓	33 ✓	34 ✓	35 ✓	36 ✗	37 ✗	38 ✓	39 ✓	40
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Which choice puts these materials in order of radiographic density, from least dense to most dense?

Air, Fat, Water, Bone, Metal	HIDE
Metal, Bone, Water, Fat, Air	HIDE
Fat, Water, Air, Metal, Bone	HIDE
Air, Water, Fat, Bone, Metal	HIDE

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Which of the following is least radio-dense?

Air, Fat,

Metal, Bone

Fat, Water

Air, Water

Correct:

The correct order, from least radio-dense to most is:

Air (black on radiographs)

Fat

Water/urine/blood

Bone

Metal (bright white)

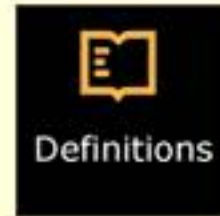
A humorous memory aid is the "5 B's":

Bubbles, Blubber, Blood, Bone, and Bullets.

Refs: Thrall's Textbook of Veterinary Diagnostic Radiology, 6th ed. and Pasquini & Spurgeon's Anatomy Dom An 11<sup>th</sup> ed. p. 604.

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41	42	43	44	45	46	47	48	49	50
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What is the primary abnormality visible in this radiograph from a dog?



Dilated cardiomyopathy	HIDE
Pleural effusion	HIDE
Vena caval syndrome	HIDE
Diaphragmatic hernia	HIDE
Pulmonary edema	HIDE

41	42	43	44	45	46	47	48	49	50
----	----	----	----	----	----	----	----	----	----

What is t



**Correct:**

This is severe **PLEURAL EFFUSION.**

Note the **raised trachea, with lung lobes floating in the dorsal chest**; lung borders outlined clearly by opacity, but the cardiac silhouette indistinct.

DDX includes NOTHING GOOD---neoplasia, CHF, hypoalbuminemia (secondary to protein-losing nephropathy/liver disease), heartworm, diaphragmatic hernia, trauma/hemothorax, lung lobe torsion to name a few.

Pulmonary edema looks different-Think splotchy, cotton-ball lungs, where the tissue of the lung itself is heavy with fluid.

Dilated

Pleural effusion

HIDE

Vena caval syndrome

HIDE

Diaphragmatic hernia

HIDE

Pulmonary edema

HIDE



Pulmonary edema



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41 ✓	42	43	44	45	46	47	48	49	50
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What type of contrast agent is typically used to make the image below?



Nonionic organic iodide (e.g., iohexol)	HIDE
There is no contrast agent in this image	HIDE
Insoluble inert radiopaque medium (e.g., barium sulfate)	HIDE
Soluble ionic organic iodide (e.g., iothalamate)	HIDE
Radiolucent gas (e.g., nitrous oxide)	HIDE



41

What type



Correct:

Myelograms like this one from a horse are performed using **soluble nonionic organic iodides** (e.g., iohexol, iopamidol, and iotolan). They are hyperosmolar but less than ionic organic iodides. There is a lower incidence of adverse reactions.

**Soluble ionic organic iodides** (e.g., iothalamate, diatrizoate) can be used orally for gastrointestinal studies; intravascularly; in joints, the urinary tract and the abdomen; in wounds; and in salivary ducts. They should NOT be used intrathecally for myelography.

**Insoluble inert radiopaque** medium such as barium sulfate is used for gastrointestinal motility studies. **Radiolucent gases** (e.g., nitrous oxide, air, and carbon dioxide) can be used for double-contrast cystograms and gastrograms.

Nonionic

There is no contrast agent in this image	HIDE
Insoluble inert radiopaque medium (e.g., barium sulfate)	HIDE
Soluble ionic organic iodide (e.g., iothalamate)	HIDE
Radiolucent gas (e.g., nitrous oxide)	HIDE



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41	42	43	44	45	46	47	48	49	50
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Which one of the following choices correctly describes **echogenicity** in ultrasonography?

Emissions created by gamma photons	HIDE
Shadowing that occurs when a sound beam hits a highly reflective surface	HIDE
Image blurring that occurs when patient's hair is not shaved	HIDE
Strength of echoes returning to the transducer	HIDE
Reverberation artifact that occurs when an ultrasound beam hits air or gas	HIDE

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**41** 

Which of the following is correct?

- Emission
- Shadow
- Image brightness
- Strength**
- Reverberation

**Correct**

Echogenicity refers to the strength of the echoes that return to the transducer after passing through the patient.

An echogenic (bright) structure produces echoes.

An anechoic (dark) structure does not produce echoes.

Echogenicity is a relative term:

A structure that is brighter than an adjacent structure is **hyperechoic**.

A structure that is darker than an adjacent structure is **hypoechoic**.

A structure that is the same echogenicity as an adjacent structure is **isoechoic**.

Echogenicity can be adjusted using control settings on the ultrasound machine. Thus, it is important to compare structures at the same depth and control settings to avoid misinterpretation of echogenicities.

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How would you change exposure settings to make an x-ray film lighter?

Increase kVp, decrease mA, increase time	HIDE
Decrease kVp, decrease mA, decrease time	HIDE
Increase kVp, increase mA, increase time	HIDE
Decrease kVp, increase mA, increase time	HIDE

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How would you make a film lighter?

Decrease kVp

Decrease mA

Decrease time

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**Correct: Decrease kVp, decrease mA, decrease time**

To make a film lighter, decrease kilovoltage (kVp), milliamperes (mA) or time (seconds).

Decreasing milliamperes (mAs) decreases the number of photons hitting the film, which exposes it less.

Lower kVp decreases photon energy (penetrating power of the x-rays through tissue).

Shorter time generates fewer electrons which also decreases exposure and therefore decreases darkness on the x-ray film once it is developed.

Refs: Tighe & Brown, Mosby's Comprehensive Review for Vet Techs, 2<sup>nd</sup> ed. pp. 176

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A 10 year old male castrated domestic short haired cat is presented with a history weight loss and muscle wasting over the course of one year.

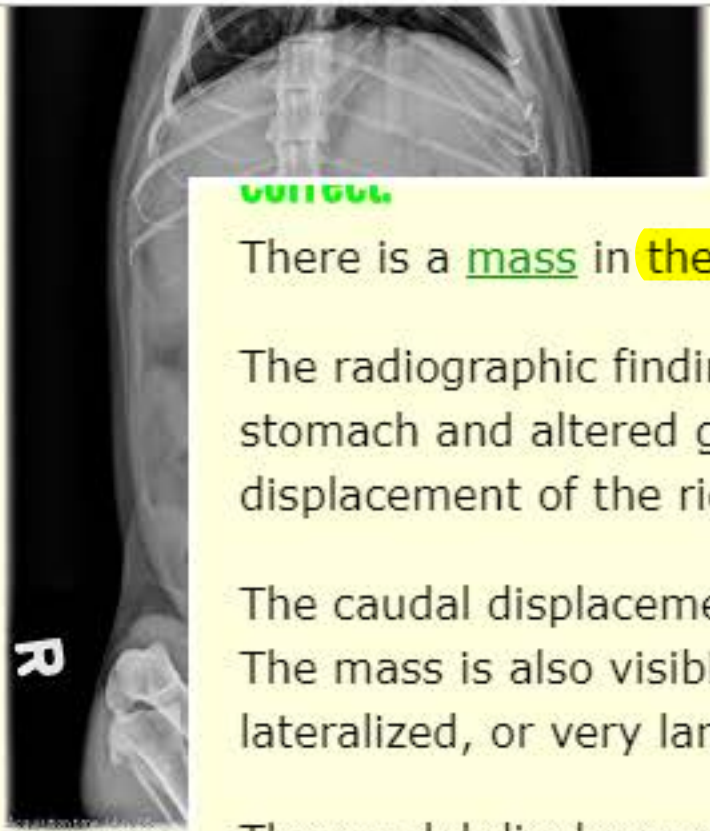
Where is the location of the abnormality?







Retroperitoneal space	HIDE
Gastrointestinal tract	HIDE
Spinal column	HIDE
Cranial abdomen	HIDE
Urinary tract	HIDE



**CORRECT.**

There is a mass in the cranial abdomen.

The radiographic findings are: cranial abdominal mass, caudal displacement of the stomach and altered gastric axis, caudal displacement of transverse colon, caudal displacement of the right kidney, and lobular mass cranial and caudal to stomach.

The caudal displacement of the stomach makes a liver mass most likely in this case. The mass is also visible caudal to the stomach, but this can occur with pedunculated, lateralized, or very large masses.

The caudal displacement of the transverse colon and right kidney also point to a hepatic mass. Remember that the right kidney is in contact with the liver in the renal fossa.

Click here to see [normal feline abdominal radiographs](#).

Retroper

Gastroin

Spinal column

Cranial abdomen

HIDE

Urinary tract

HIDE

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41 ✓	42 ✗	43 ✓	44 ✓	45 ✗	46	47	48	49	50
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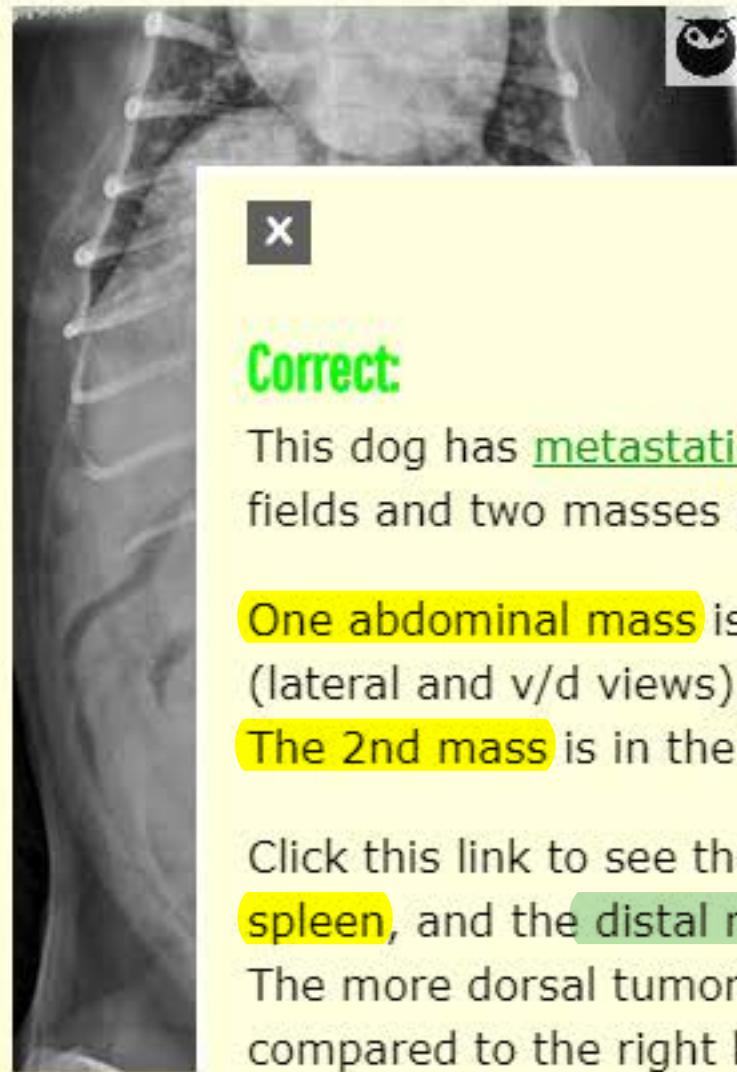
Which one of the following choices is evident on these radiographs from a 10-year-old cocker spaniel with anemia?





Normal radiographs	HIDE
Aspiration pneumonia	HIDE
Renomegaly	HIDE
Hepatomegaly	HIDE
Metastatic disease	HIDE





X

### Correct:

This dog has metastatic disease. There are multiple small nodules visible in the lung fields and two masses in the abdomen.

One abdominal mass is visible between the left kidney and the fundus of the stomach (lateral and v/d views).

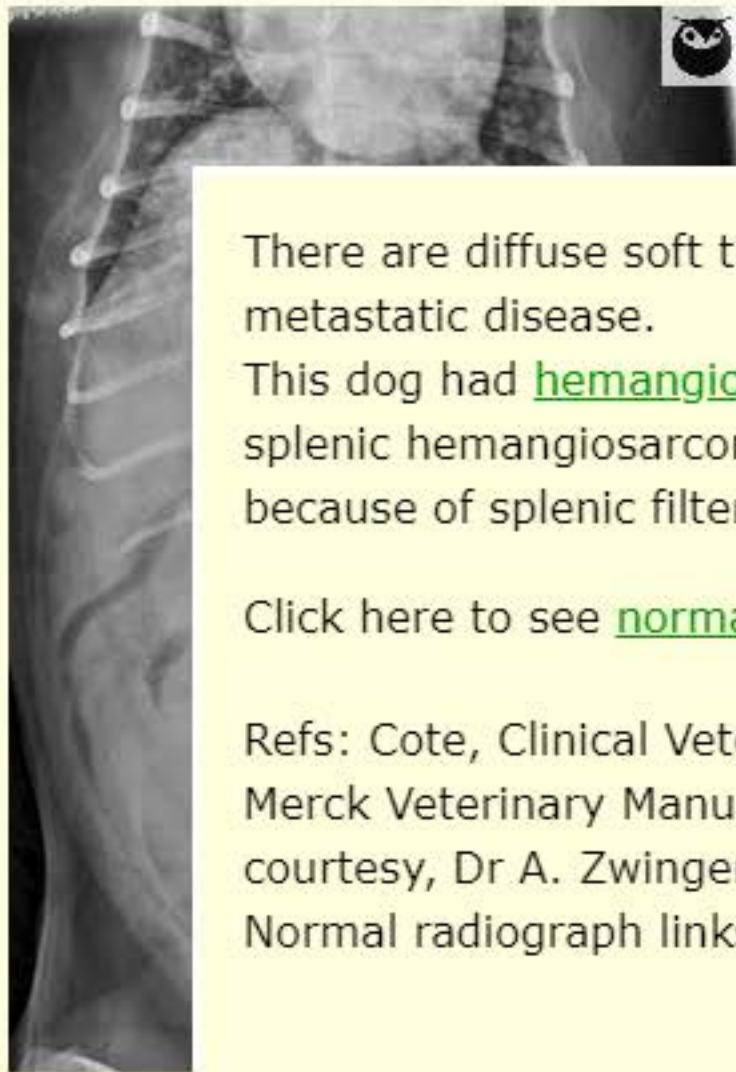
The 2nd mass is in the caudoventral abdomen, visible only on the lateral projection.

Click this link to see the dorsal mass in the location of the proximal extremity of the spleen, and the distal mass in the location of the distal extremity of the spleen.

The more dorsal tumor is causing a mass effect, displacing the left kidney caudally compared to the right kidney (visible on v/d).

Normal radiographs	HIDE
Aspiration pneumonia	HIDE
Renomegaly	HIDE
Hepatomegaly	HIDE
Metastatic disease	HIDE





There are diffuse soft tissue opacity nodules throughout the lungs, indicating metastatic disease.

This dog had [hemangiosarcoma](#) with metastatic disease. As many as a third of splenic hemangiosarcomas arise in skin or peripheral tissue, but end up in the spleen because of splenic filtering of cells in the bloodstream.

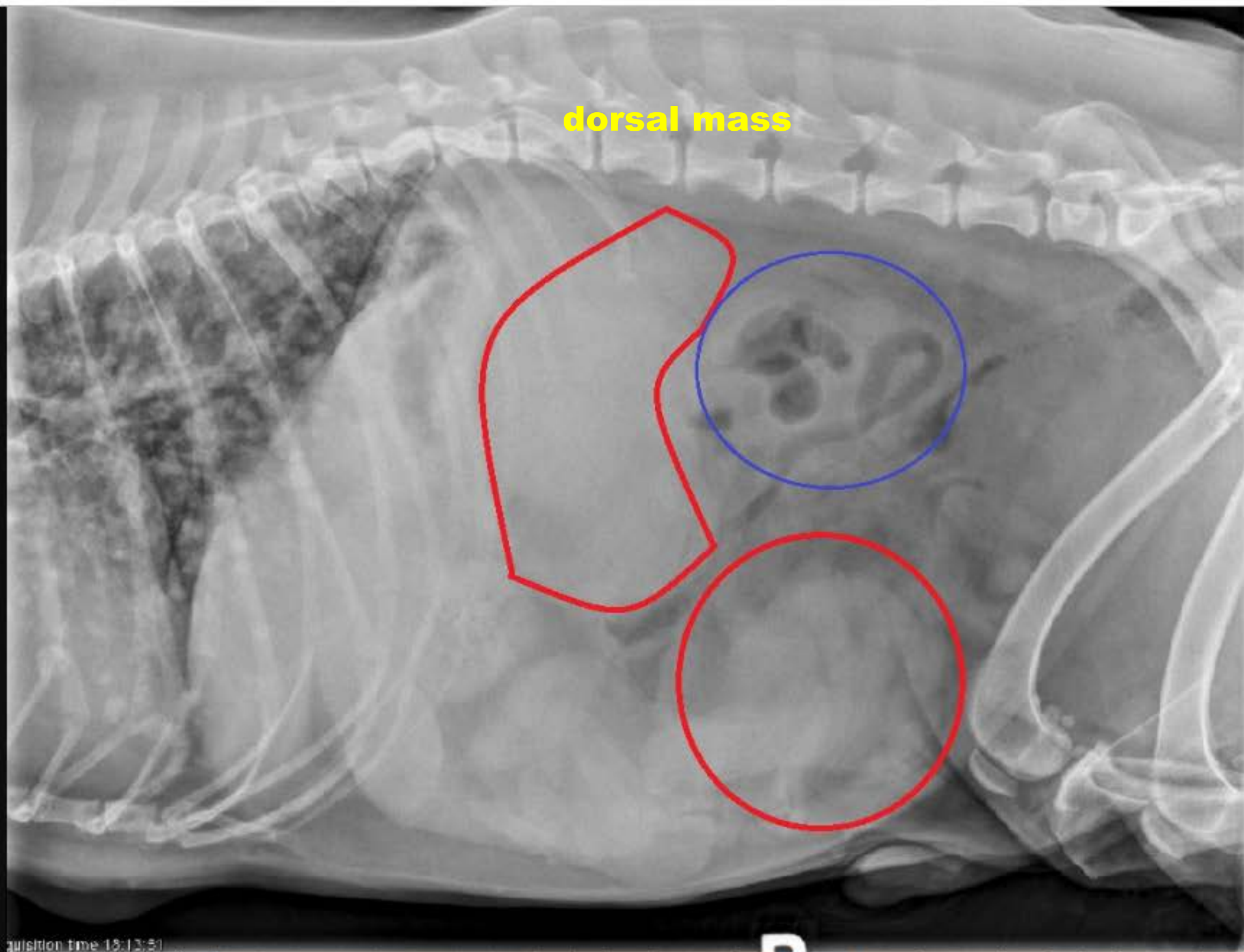
Click here to see [normal canine abdominal radiographs](#).

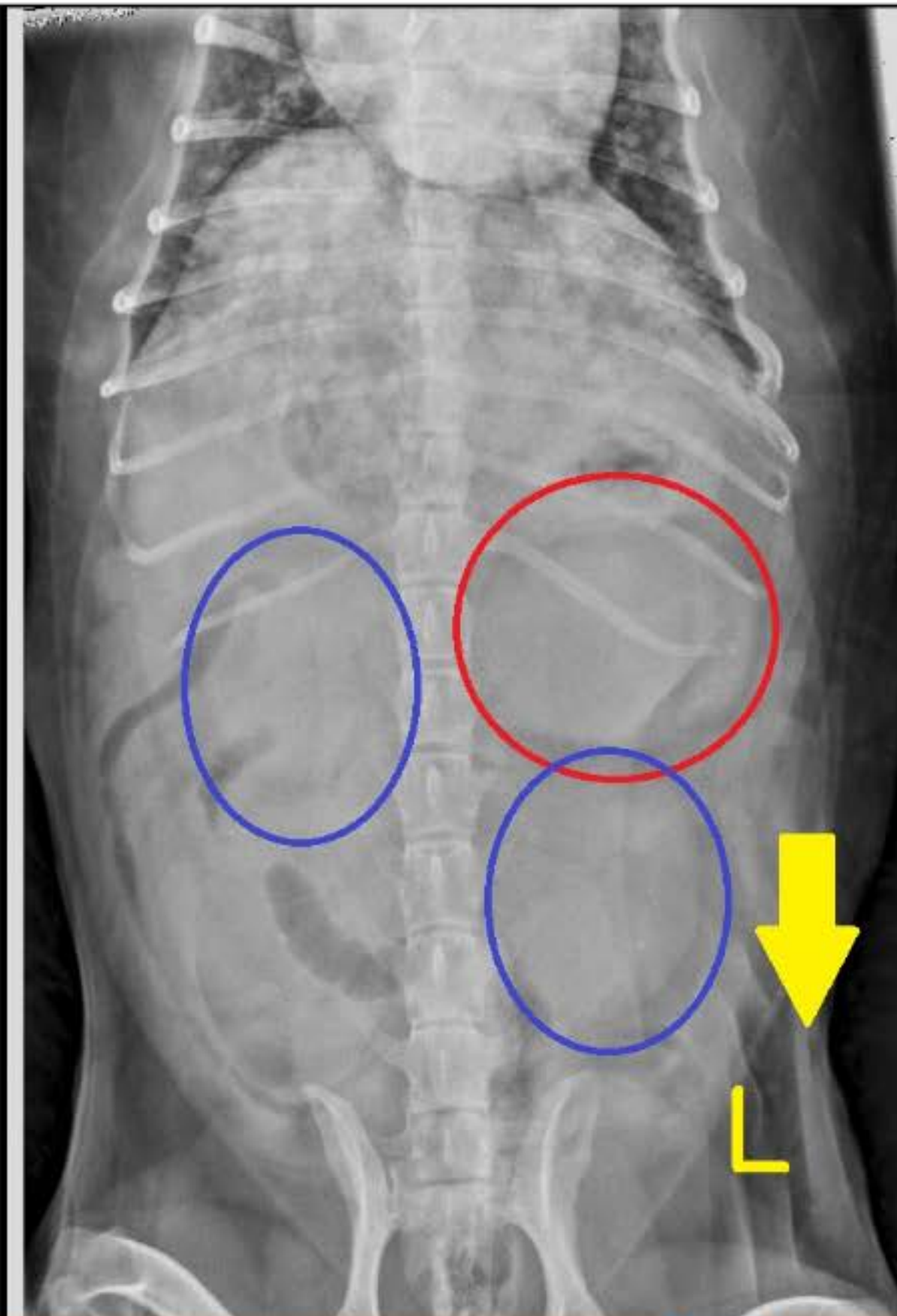
Refs: Cote, Clinical Veterinary Advisor-Dogs and Cats, 3<sup>rd</sup> ed. pp. 441-3 and the Merck Veterinary Manual online edition. Radiographic interpretation and images courtesy, Dr A. Zwingenberger and [Veterinary Radiology](#).

Normal radiograph links courtesy, [Imaging Anatomy](#) Univ. of Illinois Vet Med.

Normal radiographs	HIDE
Aspiration pneumonia	HIDE
Renomegaly	HIDE
Hepatomegaly	HIDE
Metastatic disease	HIDE







**mass effect, displacing the left kidney. caudally.**



PREVNEXT

41	42	43	44	45	46	47	48	49	50
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A 3-year-old neutered male Lhasa Apso was presented with a one month duration of left pelvic limb lameness and depression.

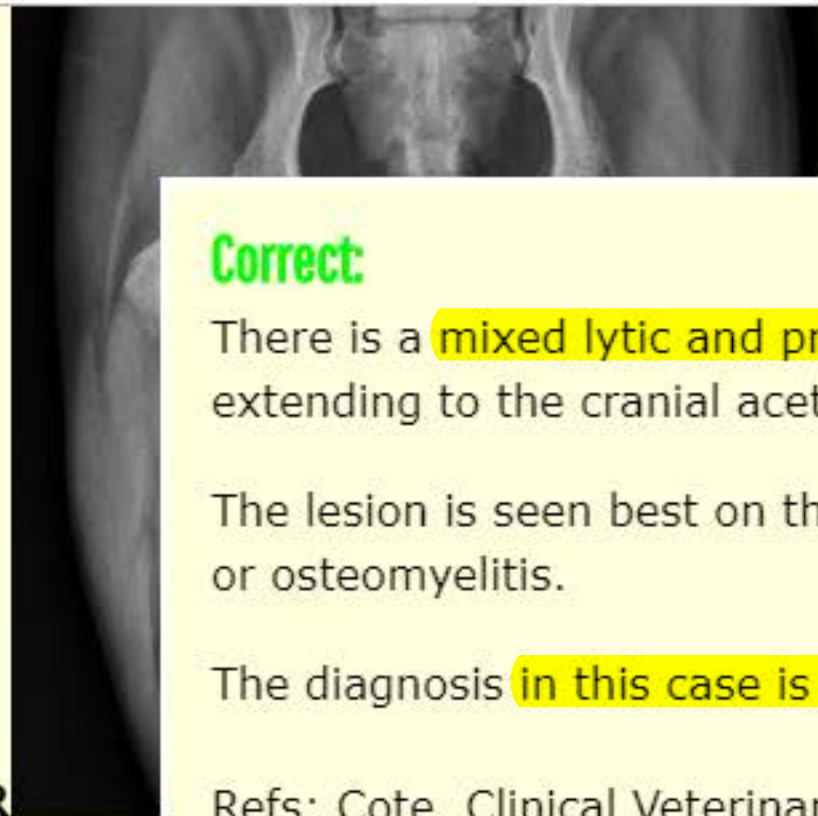
Based on the radiographs, where is the problem located?





Left stifle	HIDE
Left ilium	HIDE
Right Sacrum	HIDE
L6-7	HIDE
Right femoral head	HIDE





**Correct:**

There is a mixed lytic and productive bone lesion on the wing of the left ilium, extending to the cranial acetabulum. The femoral head is not involved.

The lesion is seen best on the v/d projection. The differentials would include neoplasia or osteomyelitis.

The diagnosis in this case is osteomyelitis secondary to coccidioidomycosis.

Refs: Cote, Clinical Veterinary Advisor-Dogs and Cats, 3<sup>rd</sup> ed. pp. 738-40 and the Merck Veterinary Manual online edition. Images courtesy, [Dr A Zwingenberger](#) and [Veterinary Radiology](#).

Left stifl

Left iliur

Right Sa

L6-7

HIDE

Right femoral head

HIDE

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41	42	43	44	45	46	47	48	49	50
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Which one of the following choices best describes the use of Digital Imaging and Communication in Medicine (DICOM) in digital radiology?

A method of obtaining digital radiographs with less radiation exposure	HIDE
A technique that transforms digital images into hard copies for storage purposes	HIDE
A means of converting traditional x-ray film into digital images	HIDE
A universal digital image format that allows sharing of images between clinics	HIDE
A mechanism that prevents artifacts from occurring on digital images	HIDE

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**41** 

**Correct:**

Digital Imaging and Communication in Medicine (DICOM) is a universal digital image format that allows sharing of electronic images with hospitals, specialists and other locations (teleradiology).

Which of the following is a method of communication in medical imaging?

DICOM is the standard image format for medical image generation and storage.

A method of communication in medical imaging

DICOM allows storage of images from a variety of different modalities (e.g., digital and computed radiography, computed tomography (CT), MRI, ultrasonography, digital fluoroscopy).

A technique used for the purpose of communication in medical imaging

The DICOM image file contains patient identification, date and time of the examination, and display formats.

A means of communication in medical imaging

A universal digital image format that allows sharing of images between clinics HIDE

A mechanism that prevents artifacts from occurring on digital images HIDE

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41	42	43	44	45	46	47	48	49	50
✓	✗	✓	✓	✗	✗	✗	M ✓		

What does an **underexposed** radiograph look like?

Speckled	HIDE
Transparent	HIDE
Very white	HIDE
Very dark	HIDE
Foggy	HIDE

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What do

Speckle

Transpa

Very wh

Very dar

Foggy

**Correct: Very white**

An underexposed radiograph has not had enough exposure to x-rays, and will be **LIGHTER**.

An **overexposed** radiograph has had too much exposure to x-rays, and it will be DARKER.

Remember that the patient's body stops some x-rays from penetrating all the way to the x-ray film, which lies UNDER the patient.


Wherever the body is, the underlying film is whiter, more pale, lighter.

Wherever there is no body in the way, the radiograph will be very dark or black,

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What do

**Speckle**

Transpa

Very wh

Very dar

Foggy

the x-ray film, which lies UNDER the patient.

Wherever the body is, the underlying film is whiter, more pale, lighter.

Wherever there is no body in the way, the radiograph will be very dark or black, because the x-rays penetrate and expose the film without any tissues to stop them.

For good tables that list common technical errors in taking and developing x-ray films, see Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 541-2, boxes 16-2 and 16-3.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 541-2.

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41	42	43	44	45	46	47	48	49	50
✓	✗	✓	✓	✗	✗	✗	M ✓	✗	

If you take an x-ray of a cat chest at 200 milliamperes for 1/10<sup>th</sup> of a second, how millliampere-seconds is the exposure?

2000 mAs	HIDE
20 mAs	HIDE
10 mAs	HIDE
200 mAs	HIDE

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If you ta  
milliamp

- 2000 m
- 20 mAs
- 10 mAs
- 200 mA

X

Correct:

Together, milliamperes-seconds equals mA multiplied by time (mA X sec=mAs), which controls the intensity of an x-ray.

In this question,  $200 \times 1/10 = 20 \text{ mAs}$ .

Milliamperes (mA) are the QUANTITY of electrons produced by the x-ray machine and exposure time (sec) is how LONG you expose the animal to these rays.

More mA, or longer exposure time, means a DARKER x-ray.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8<sup>th</sup> ed. pp. 529-32

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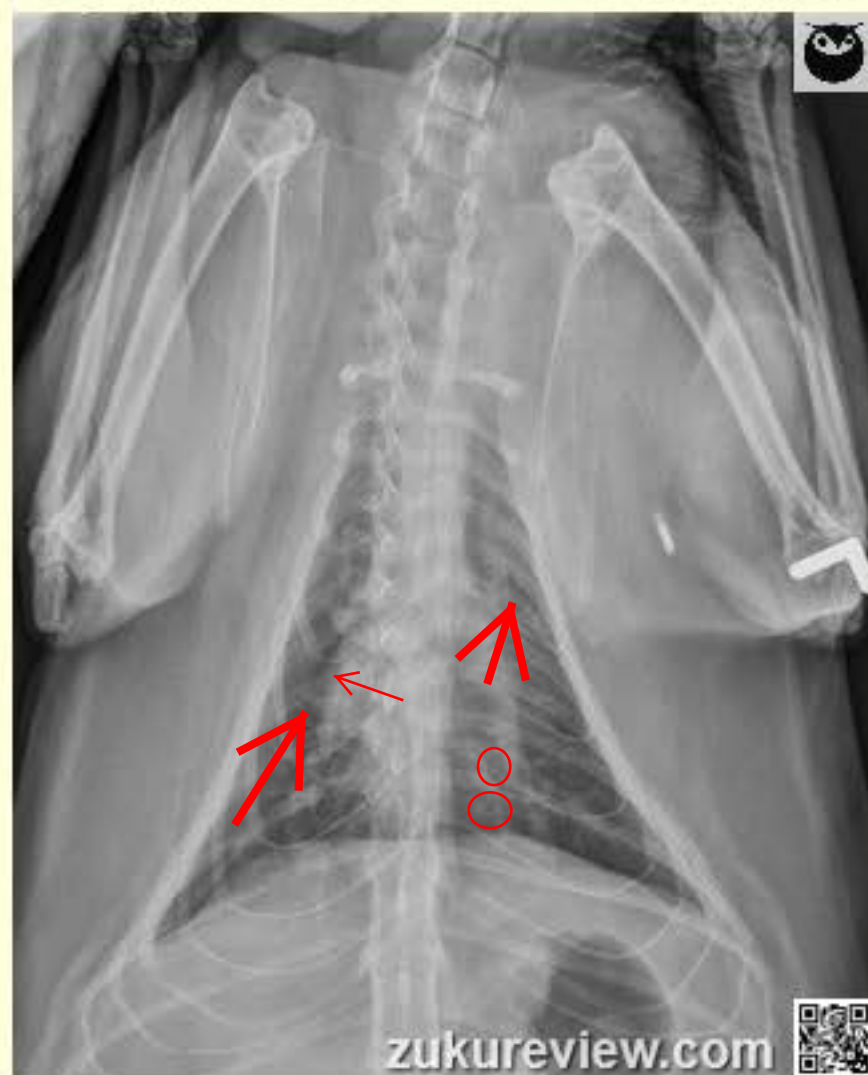
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51	52	53	54	55	56	57	58	59	60
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A 9-year-old female DSH cat is presented with periodic non-productive coughing.

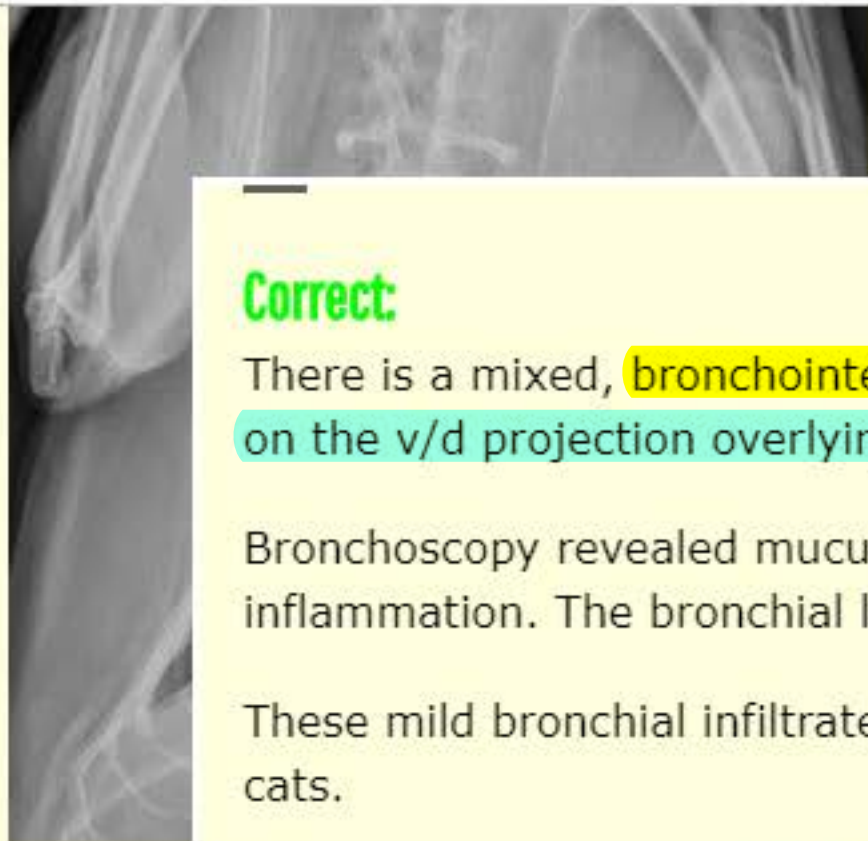
Which one of the following choices is found on these radiographs?





Cranial mediastinal mass	HIDE
Normal radiographs	HIDE
Bronchointerstitial pattern	HIDE
Cardiomegaly	HIDE
Retropharyngeal mass	HIDE





**Correct:**

There is a mixed, **bronchointerstitial pattern** throughout the lungs. **Donuts** are visible on the v/d projection overlying the diaphragm.

Bronchoscopy revealed mucus plugging of small airways and evidence of inflammation. The bronchial lavage was also inflammatory in nature.

These mild bronchial infiltrates are characteristic of inflammatory airway disease in cats.

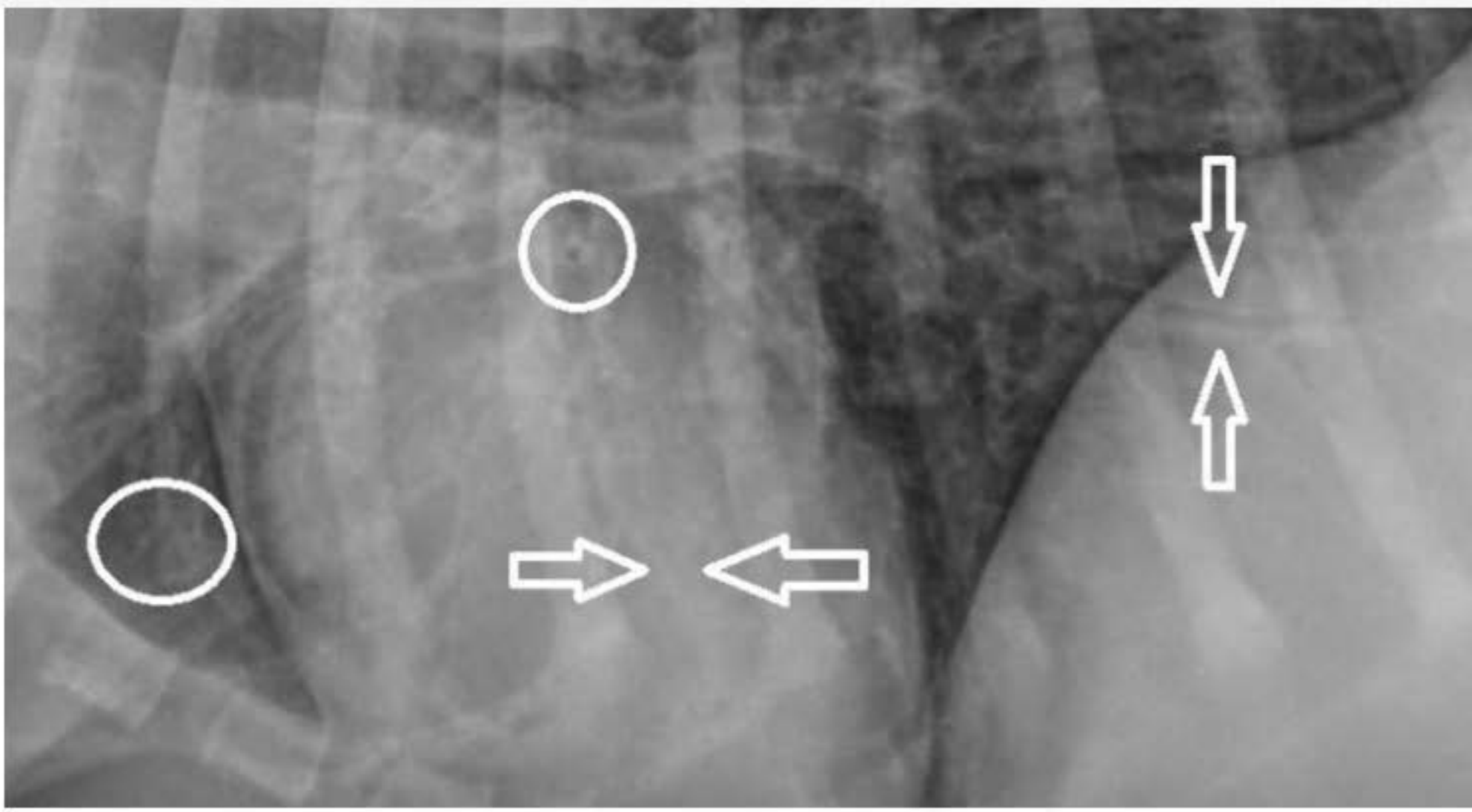
Click here to see normal feline thoracic radiographs.

Refs: Cote, Clinical Veterinary Advisor-Dogs and Cats, 3<sup>rd</sup> ed. pp. 90-2 and the Merck Veterinary Manual online edition. Radiographic interpretation and images courtesy, Dr

Cranial	
Normal	
Bronchointerstitial pattern	HIDE
Cardiomegaly	HIDE
Retropharyngeal mass	HIDE

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**Figure 2.** Lateral thoracic radiograph of a 1-year-old border collie who presented for coughing, sneezing, oculonasal discharge and fever, diagnosed with infectious tracheobronchitis. Note thickened/fuzzy and prominent airway walls in the pulmonary periphery (white arrows = "tram tracks", white circles = "doughnuts").



 **zukureview**

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51	52	53	54	55	56	57	58	59	60
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Which of the following would be a clinical presentation that might best be imaged using fluoroscopy?

Osteomyelitis of cervical vertebra	HIDE
Tibial fracture	HIDE
Regurgitation	HIDE
Interstitial pneumonia	HIDE
Paranasal sinusitis	HIDE

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Which of fluoroscopy is used for gastrointestinal motility studies (such as evaluating an animal with regurgitation), tracheal studies, cardiovascular imaging, and some myelograms.

Osteomyelitis

Tibial fracture

Regurgitation

Interstitial pneumonia

Paranasal sinusitis

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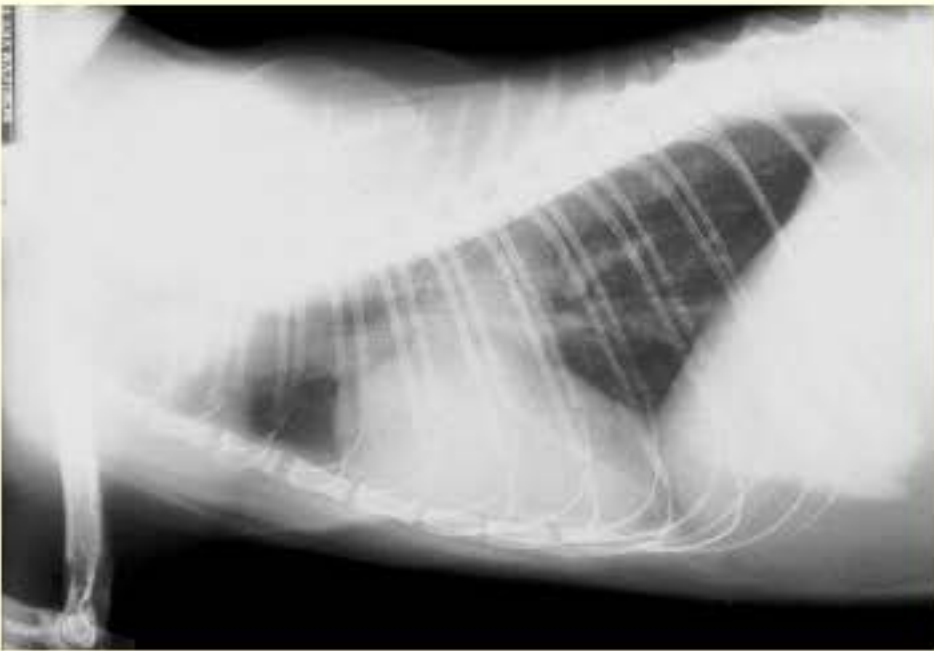
NEXT





51 ✓	52 ✗	53	54	55	56	57	58	59	60
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What disease would cause this radiographic presentation in a cat?



Mitral stenosis	HIDE
Pericardial lymphosarcoma	HIDE
Feline asthma	HIDE
Chemodectoma	HIDE
Hypertrophic cardiomyopathy	HIDE

51	52	53	54	55	56	57	58	59	60
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What dis



**Correct:** Hypertrophic cardiomyopathy

This is a very enlarged heart-Note how much of the heart is lying on the sternum. The cat is likely to present with signs of congestive heart failure (exercise intolerance, dyspnea, poor perfusion, cyanosis). Think first of hypertrophic cardiomyopathy (HCM) in middle-aged male cats, but Hyperthyroidism, Systemic hypertension, Acromegaly, and congenital aortic stenosis (younger animals) are also on your DDX.

**REMEMBER** HCM cats are PRONE to aortic thromboembolism (present with acutely paralyzed, cold hindlimbs. Follow this link to see thickened L ventricle and aortic thrombus on necropsy.

Follow this link to see the classic "Valentine heart" of feline HCM.

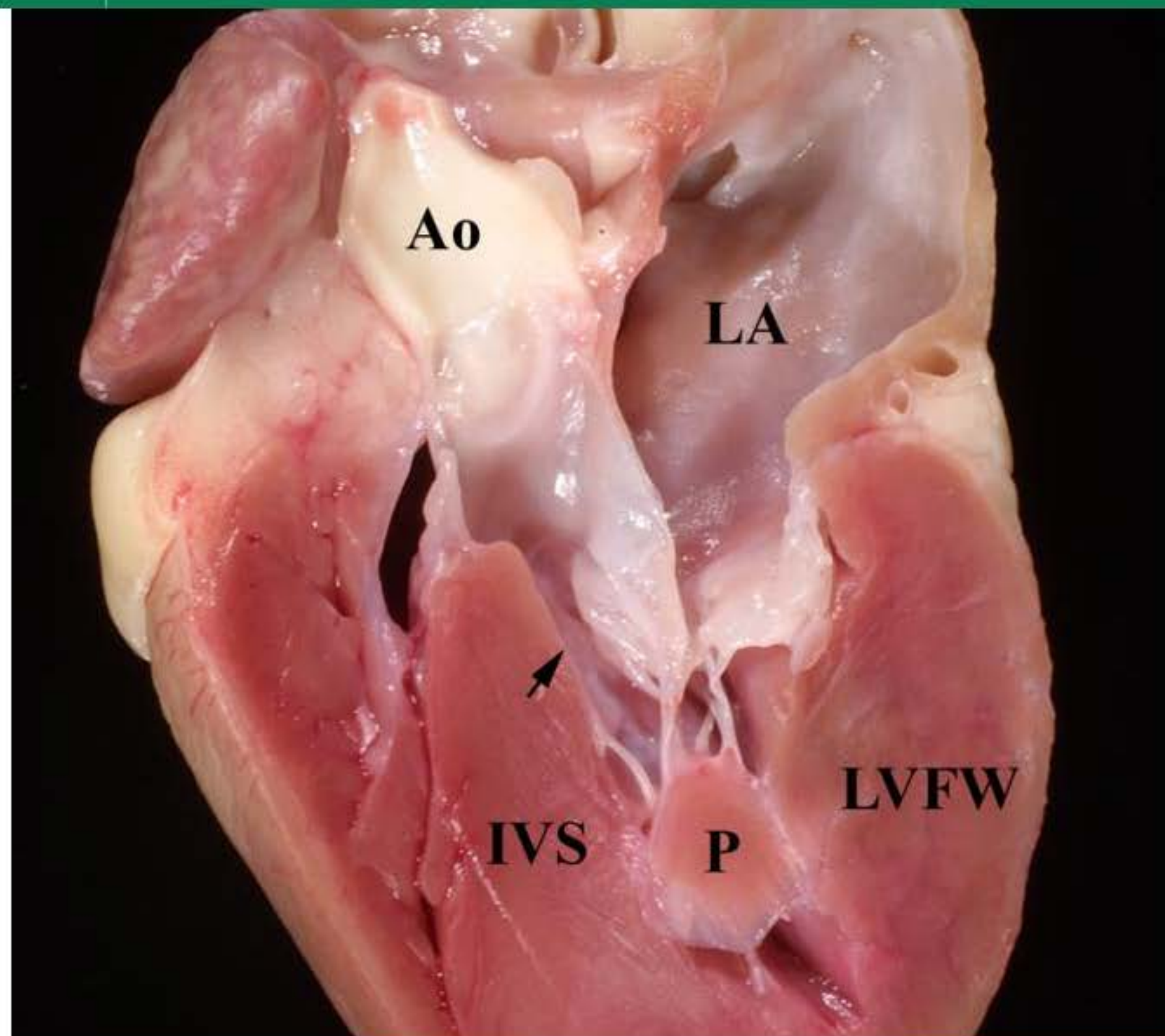
Mitral st

Refs: Blackwell's 5-Minute Vet Consult Canine Feline 4th ed pp 212-13 904-05

Pericardial lymphosarcoma	HIDE
Feline asthma	HIDE
Chemodectoma	HIDE
Hypertrophic cardiomyopathy	HIDE

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**Interventricular septum (IVS), left ventricular free wall (LVFW), aorta (Ao), left atrium (LA).  
Arrow points to narrowed left ventricular outflow tract.**



**Valentine heart" of feline HCM.**



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51	52	53	54	55	56	57	58	59	60
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In digital radiography, which one of the following choices best describes planking artifact?

Linear striations in the background of the image	HIDE
A non-uniform appearance of the image	HIDE
Disappearance of the soft tissues surrounding bone	HIDE
An image with a diffuse grainy appearance	HIDE
A lucent halo surrounding a metal implant	HIDE

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51

- In digital
- Linear s
- A non-u
- Disappe
- An imag
- A lucent

**Correct:**

Planking artifact, caused by overexposure or plate saturation, results in linear striations in the background of the image.

Uberschwinger artifact results in a lucent halo around metal implants. This can be mistaken for bone lysis around an implant.

Severe underexposure can result in an image with a grainy appearance, also called "noise" or "quantum mottle".

Improper use of the "heel effect" will cause a non-uniform appearance of the image.

The heel effect occurs when the x-ray beam is more intense at the cathode side

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In digital

Linear s

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Improper use of the "heel effect" will cause a non-uniform appearance of the image.

The heel effect occurs when the x-ray beam is more intense at the cathode side compared to the anode side, resulting in uneven x-ray photon distribution.

Overexposure causes disappearance of the soft tissues surrounding bone.

Click to see examples of [several radiographic artifacts](#) from The Ohio State University's website.

Refs: McCurnin and Bassert, Clinical Textbook for Veterinary Technicians, 9<sup>th</sup> ed. pp. 480-6.

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51	52	53	54	55	56	57	58	59	60
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Which of the following statements about magnetic resonance imaging (MRI) is true?

Metal objects cannot be used in the MRI suite	HIDE
Patients do not need to be heavily sedated/anesthetized	HIDE
The MRI is very quiet	HIDE
MRI reconstructs thin x-ray beam slices taken of the patient	HIDE
Most veterinary practices have an MRI	HIDE

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- Which of
- Metal ob
  - Patients**
  - The MRI
  - MRI rec
  - Most veter

**CORRECT** **Metal objects cannot be used in the MRI suite**

MRI uses a large magnet so no metal objects can be used around the machine/in the MRI suite. Serious injury can occur if this is forgotten. The magnet alters the hydrogen nuclei of the body's cells and then creates an image based on the intensity of the wave signals from these nuclei.

No ionizing radiation is used (unlike CT, radiography, and fluoroscopy).

In addition, no devices with radiofrequency signals can be close to the MRI, and credit cards and watches can also be permanently damaged.

The magnet is very loud during a scan. Technicians should wear ear protection and patients should have their ears plugged with cotton.

Many teaching hospitals have MRI, but few private practices have their own. Mobile units and referral imaging centers are other locations that offer MRI.

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51 ✓	52 ✗	53 ✓	54 ✗	55 ✗	56	57	58	59	60
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A 1-year-old spayed female mixed terrier is presented with a one-week history of coughing, lethargy, fever, and inappetence.

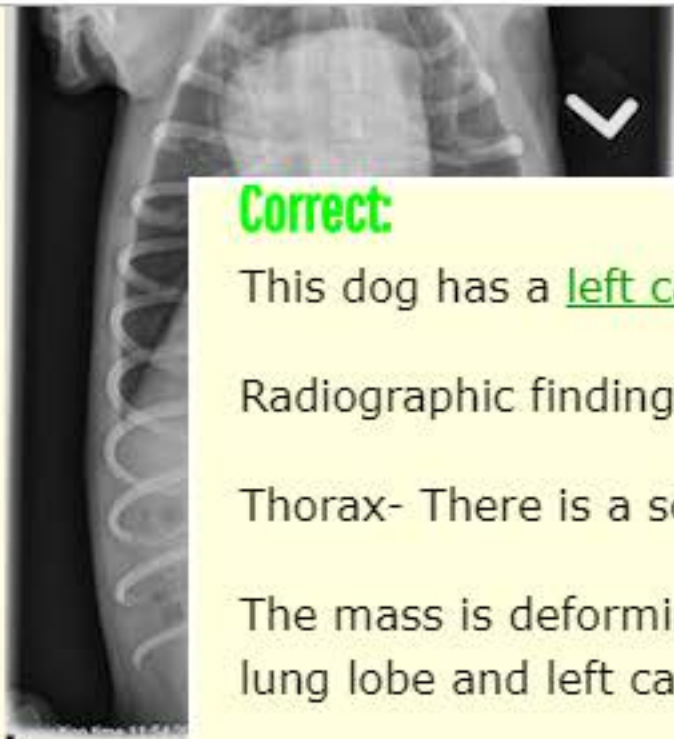
Based on the history and images, which one of the following choices is the most likely diagnosis?







Left caudal lung lobe abscess	HIDE
<i>Spirocerca lupi</i>	HIDE
Hiatal hernia	HIDE
Diaphragmatic hernia of ventral liver lobe	HIDE
Heartworm disease	HIDE



Correct:

This dog has a left caudal lung lobe abscess.

Radiographic findings:

Thorax- There is a soft tissue opacity mass present in the left caudal lung lobe.

The mass is deforming the border between the caudal subsegment of the left cranial lung lobe and left caudal lung lobe on the right lateral projection.

There is increased opacity in the pleural space with visible fissure lines indicating a small pleural effusion.

The cardiovascular structures are normal in size and shape.

The musculoskeletal structures and portion of the abdomen included are normal.

Left cau

Spirocer

Hiatal hernia

HIDE

Diaphragmatic hernia of ventral liver lobe

HIDE

Heartworm disease

HIDE

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These findings could have been compatible with either an abscess or a granuloma.

In this case a lobectomy was performed and an abscess was confirmed.

Hiatal hernias typically show a mediastinal density or mass that may appear and disappear on repeated radiographs.

Secondary aspiration pneumonia can be a problem in a patient with a hiatal hernia.

Refs: Cote, Clinical Veterinary Advisor-Dogs and Cats, 3<sup>rd</sup> ed. pp. 6-7 and the Merck Veterinary Manual online edition. Radiographic interpretation and images courtesy, Dr A. Zwingenberger and Veterinary Radiology.

Left cau

*Spirocer*

Hiatal hernia

HIDE

Diaphragmatic hernia of ventral liver lobe

HIDE

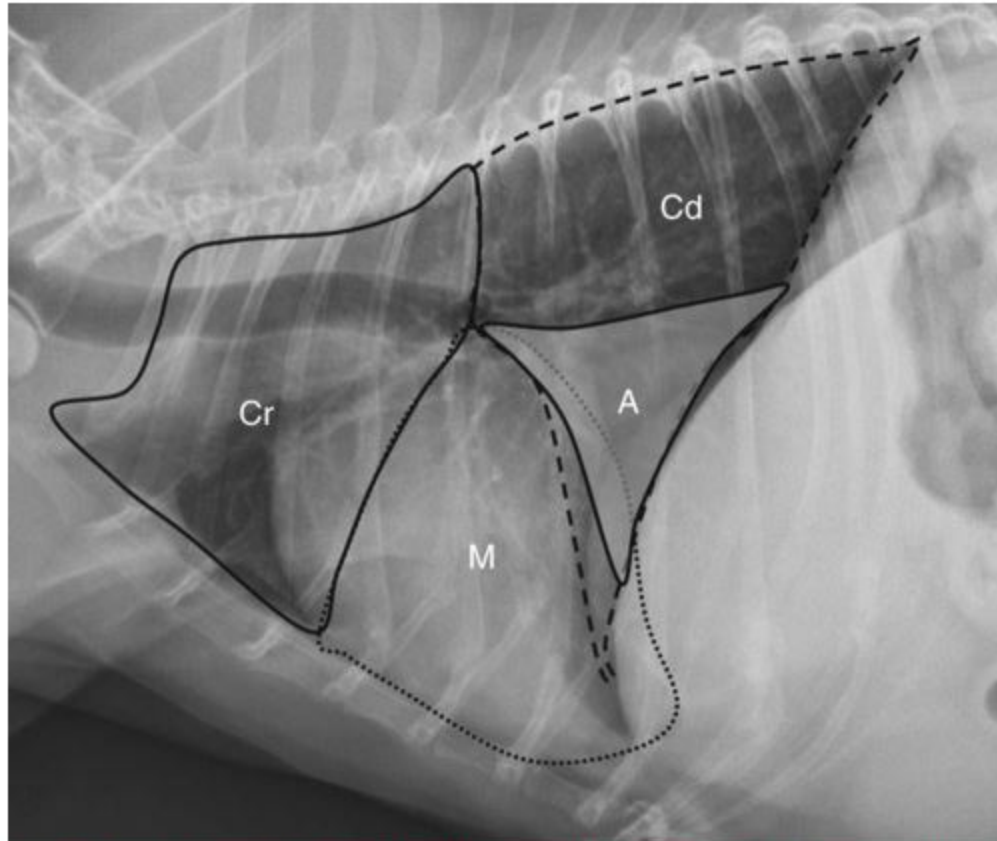
Heartworm disease

HIDE

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**Lateral canine thoracic radiograph where the approximate location of lung lobes is indicated.**

**A, Accessory lobe**

**Cd, right and left caudal lobes**

**Cr, right cranial lobe and cranial segment of left cranial lobe**

**M, right middle lobe and caudal segment of left cranial lobe.**

**FIG. 33-1** Lateral canine thoracic radiograph where the approximate location of lung lobes is indicated. A, Accessory lobe; Cd, right and left caudal lobes; Cr, right cranial lobe and cranial segment of left cranial lobe; M, right middle lobe and caudal segment of left cranial lobe.





**Ventrrodorsal canine thoracic radiograph where the approximate location of lung lobes is indicated.**

**A, Accessory lobe**

**LCd, left caudal lobe**

**LCr-Cd, caudal segment of left cranial lobe**

**LCr-Cr, cranial segment of left cranial lobe**

**RCd, right caudal lobe**

**RCr, right cranial lobe**

**RM, right middle lobe**

**FIG. 33-2** Ventrrodorsal canine thoracic radiograph where the approximate location of lung lobes is indicated. A, Accessory lobe; LCd, left caudal lobe; LCr-Cd, caudal segment of left cranial lobe; LCr-Cr, cranial segment of left cranial lobe; RCd, right caudal lobe; RCr, right cranial lobe; RM, right middle lobe.

# Hiatal hernia, radiograph, dog



Hiatal hernia in a dog (radiograph, lateral projection).  
*Courtesy of Dr. Ronald Green.*



**zukureview**

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51	52	53	54	55	56	57	58	59	60
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What is the correct order of radiographic density, from least radiographically dense to most radiographically dense?

Fat-air-water-fat-metal-bone	HIDE
Air-fat-water-bone-metal	HIDE
Metal-bone-water-fat-air	HIDE
Water-air-fat-bone-metal	HIDE
Bone-metal--water-fat-air	HIDE

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What is the order of radiographic density from least dense (black on x-ray) to most dense (white on x-ray) goes in this order: AIR-FAT-WATER-BONE-METAL.

- Fat-air-water-bone-metal
- Air-fat-water-bone-metal**
- Metal-bone-water-fat-air
- Water-air-bone-metal

Bone-metal--water-fat-air **HIDE**

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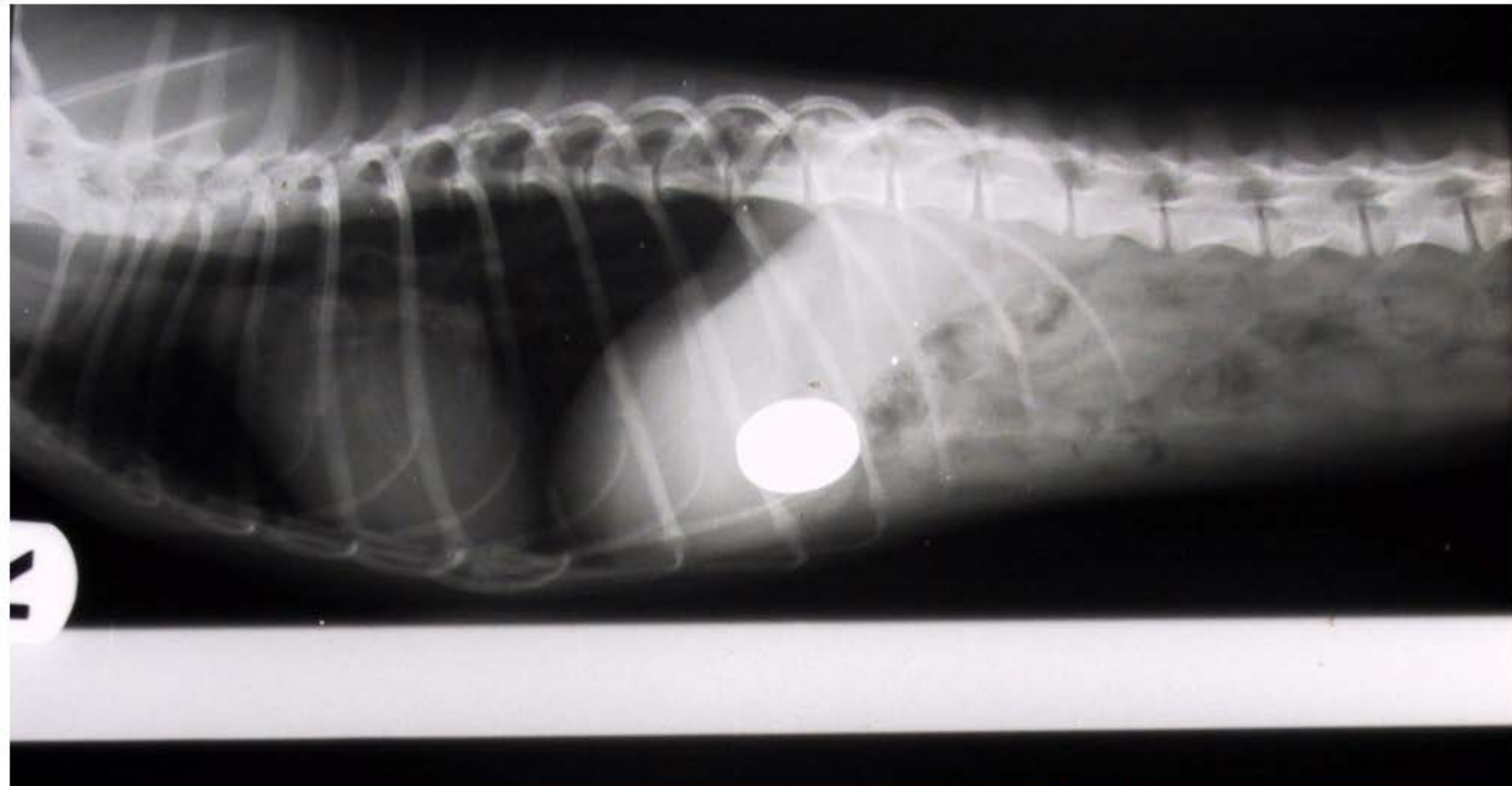
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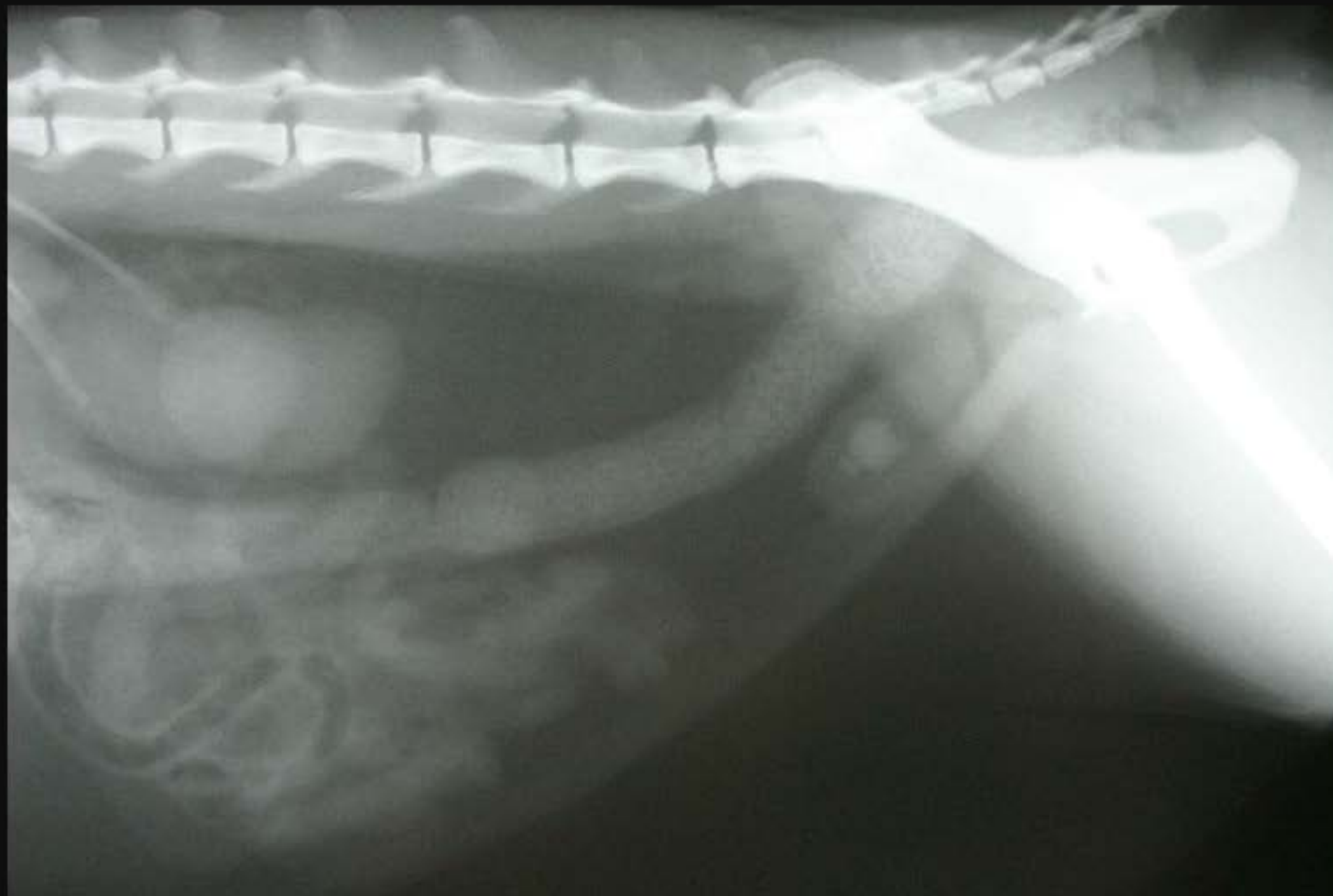
 **Report a Problem**



Gastric foreign body, USA penny



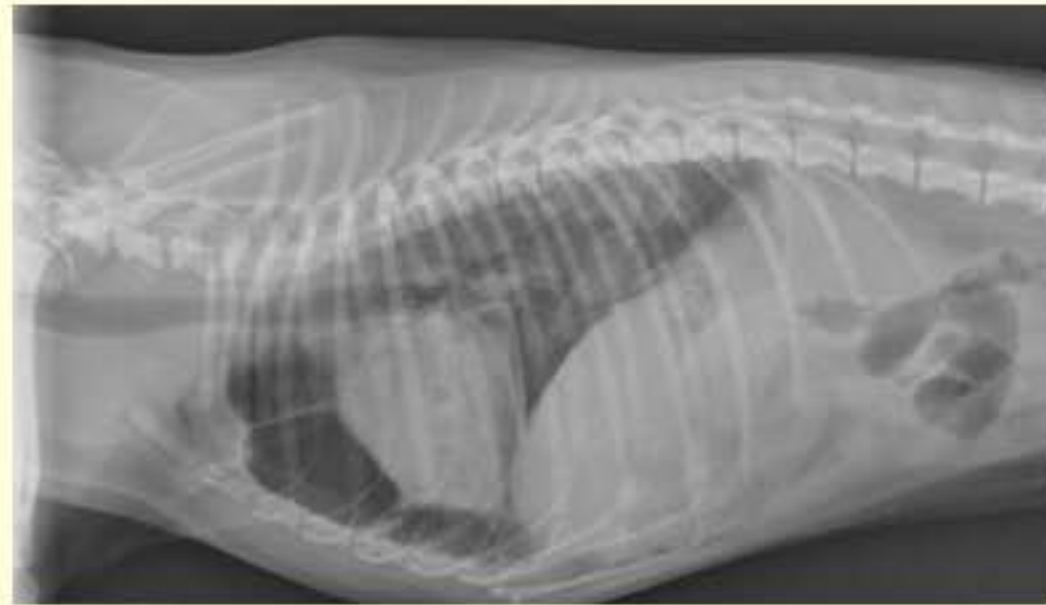
**urolith in a urinefilled bladder**





51	✓	52	✗	53	✓	54	✗	55	✗	56	✗	57	✓	58		59		60	
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What physical finding would be expected from a dog with the radiograph seen below?



Washing machine murmur	HIDE
Post-prandial regurgitation	HIDE
Hindlimb paresis	HIDE
Palpable intussusception	HIDE
Reduced lung sounds	HIDE

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What ph

Correct:

This is traumatic pneumothorax. Note the dark airspace below the heart and the retraction of the lung lobes from the chest.



Decreased to absent lung sounds with a history of recent trauma strongly suggest pneumothorax.

Refs: Cote, Clinical Veterinary Advisor-Dogs and Cats, 3<sup>rd</sup> ed. pp. 816-7, Pasquini, Tschauner's Guide to Sm An Clinics, 2<sup>nd</sup> ed. p. 161, 224-8, and the Merck Veterinary Manual online edition. Image courtesy of Dr. Terri DeFrancesco, Copyright 2017, All rights reserved.

Hindlimb paresis	HIDE
Reduced lung sounds	HIDE
Washing machine murmur	HIDE
Palpable intussusception	HIDE
Post-prandial regurgitation	HIDE



51	52	53	54	55	56	57	58	59	60
✓	✗	✓	✗	✗	✗	✓	M ✓		

A 2-year-old female spayed German shepherd is presented with recurrent left thoracic limb lameness that is aggravated by exercise.

Which one of the following choices is the most likely diagnosis?





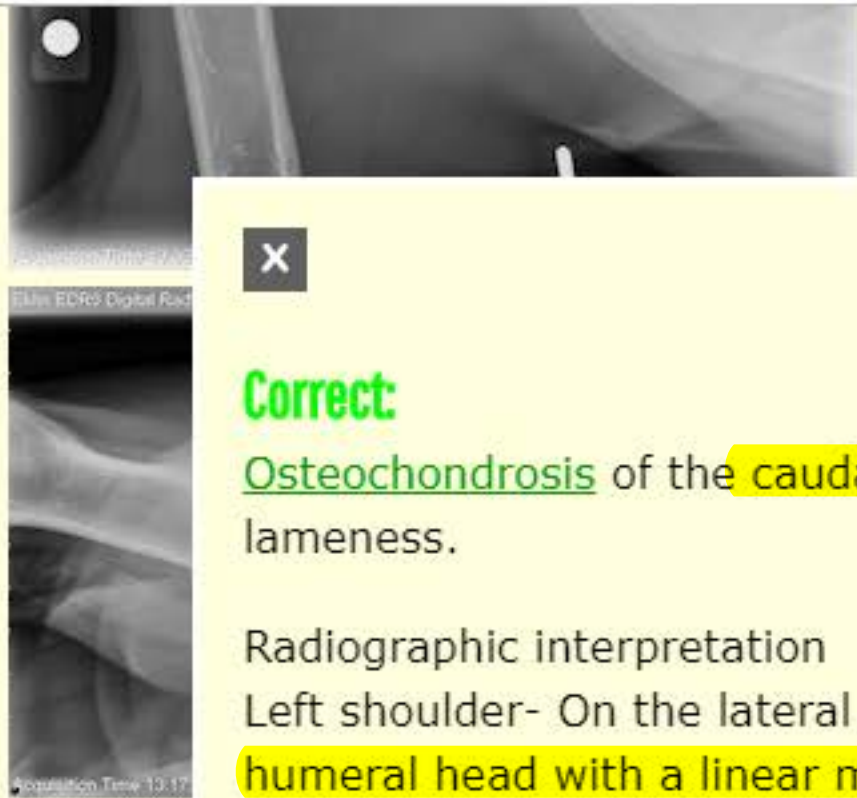
Images courtesy, [Veterinary Radiology](#).

Osteosarcoma	HIDE
Panosteitis	HIDE
Osteochondrosis	HIDE
Hypertrophic osteodystrophy	HIDE
Hypertrophic osteopathy	HIDE

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**Correct:**

Osteochondrosis of the **caudal humeral head** is the cause of the intermittent lameness.

Radiographic interpretation

Left shoulder- On the lateral radiograph, there is flattening of the caudal aspect of the **humeral head with a linear mineral density that is separated from the joint surface.**

There is mild sclerosis of the caudal humeral head.

Osteophytes are present on the caudal glenoid as well as in the inter-turburcular groove. On the ventrodorsal projections, osteophytes are additionally visible on the medial and lateral aspects of the glenoid.

Images c

Osteosa

Panoste

Osteochondrosis

HIDE

**Hypertrophic osteodystrophy**

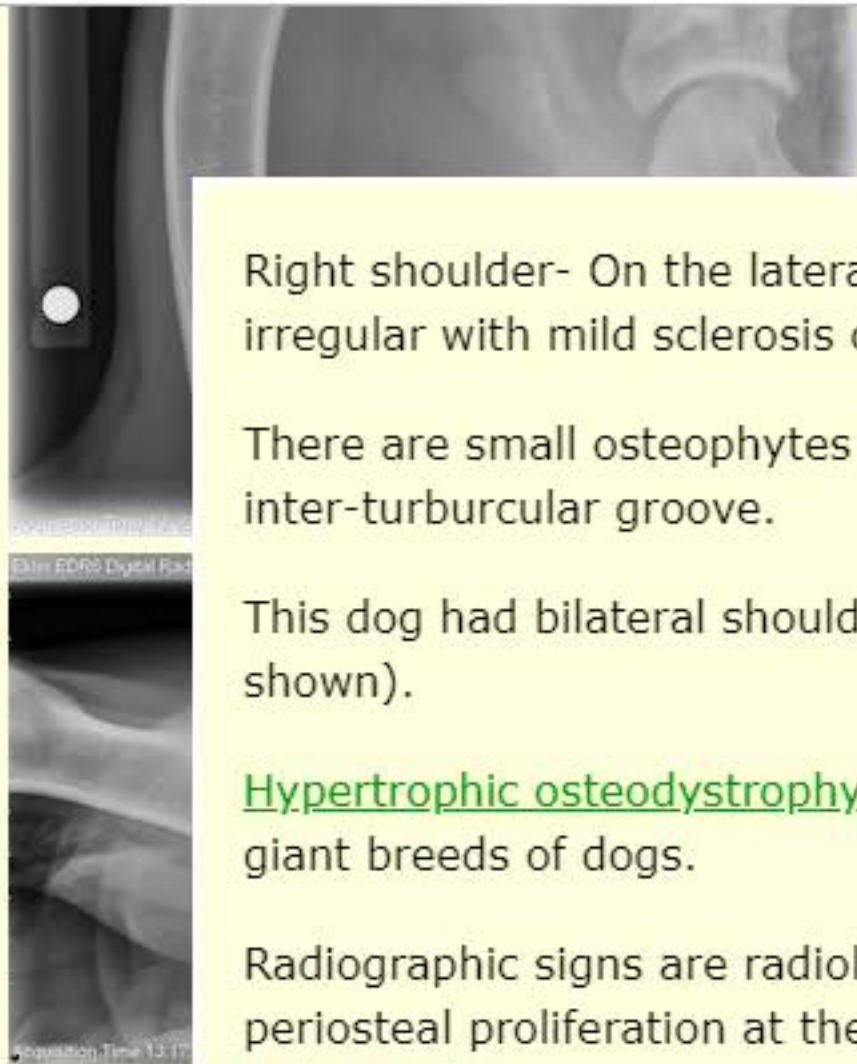
HIDE

Hypertrophic osteopathy

HIDE

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Right shoulder- On the lateral radiograph, the caudal humeral head is flattened and irregular with mild sclerosis of the subchondral bone.

There are small osteophytes present on the caudal and distal glenoid as well as the inter-turburcular groove.

This dog had bilateral shoulder osteochondrosis. (Radiographs of right shoulder not shown).

[Hypertrophic osteodystrophy](#) is a metaphyseal disorder of the long bones in large and giant breeds of dogs.

Radiographic signs are radiolucent lines parallel to the epiphyseal growth plates, and periosteal proliferation at the metaphysis. Click here to see [normal canine shoulder radiographs](#).

Images

Osteosarcoma	HIDE
Panosteitis	HIDE
Osteochondrosis	HIDE
Hypertrophic osteodystrophy	HIDE



**zukureview**

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51	52	53	54	55	56	57	58	59	60
✓	✗	✓	✗	✗	✗	✓	M ✓	✗	

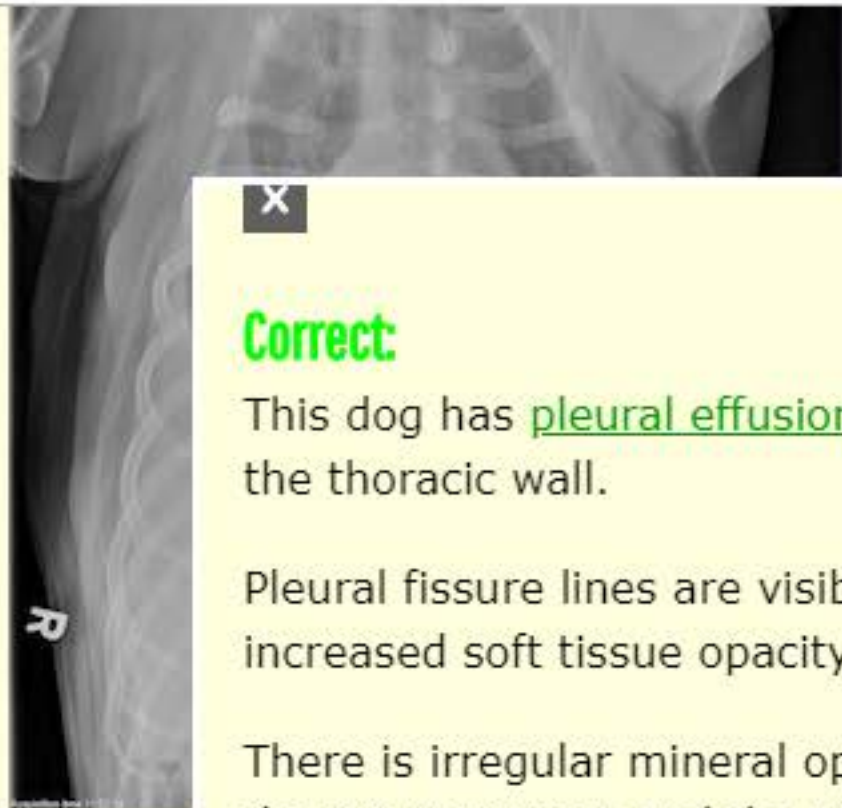
What abnormality is present on these thoracic radiographs from a 6-year-old Labrador retriever?





Pleural effusion	HIDE
Interstitial pattern	HIDE
Alveolar pattern	HIDE
Bronchiolar pattern	HIDE
Vascular pattern	HIDE





### Correct:

This dog has pleural effusion. There is a severe retraction of the right lung lobes from the thoracic wall.

Pleural fissure lines are visible in the right and left side of the thorax. There is an increased soft tissue opacity in the right caudal lung lobe.

There is irregular mineral opacity associated with the right middle lung lobe visible on the DV projection and the right lateral projection. On the left side the lung lobe margins are mildly rounded.

The cardiac silhouette is difficult to identify. Within the viewable abdomen there is decreased serosal detail.

Pleural effusion

Interstitial pattern

Alveolar pattern

Bronchiolar pattern

HIDE

Vascular pattern

HIDE

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*This is the last question. Click Save and Exit after you finish it.*