Recent Advances of Diagnostic Imaging in Veterinary Oncology
(Technique and Application)

Presented by Dr. Saghar Karimi
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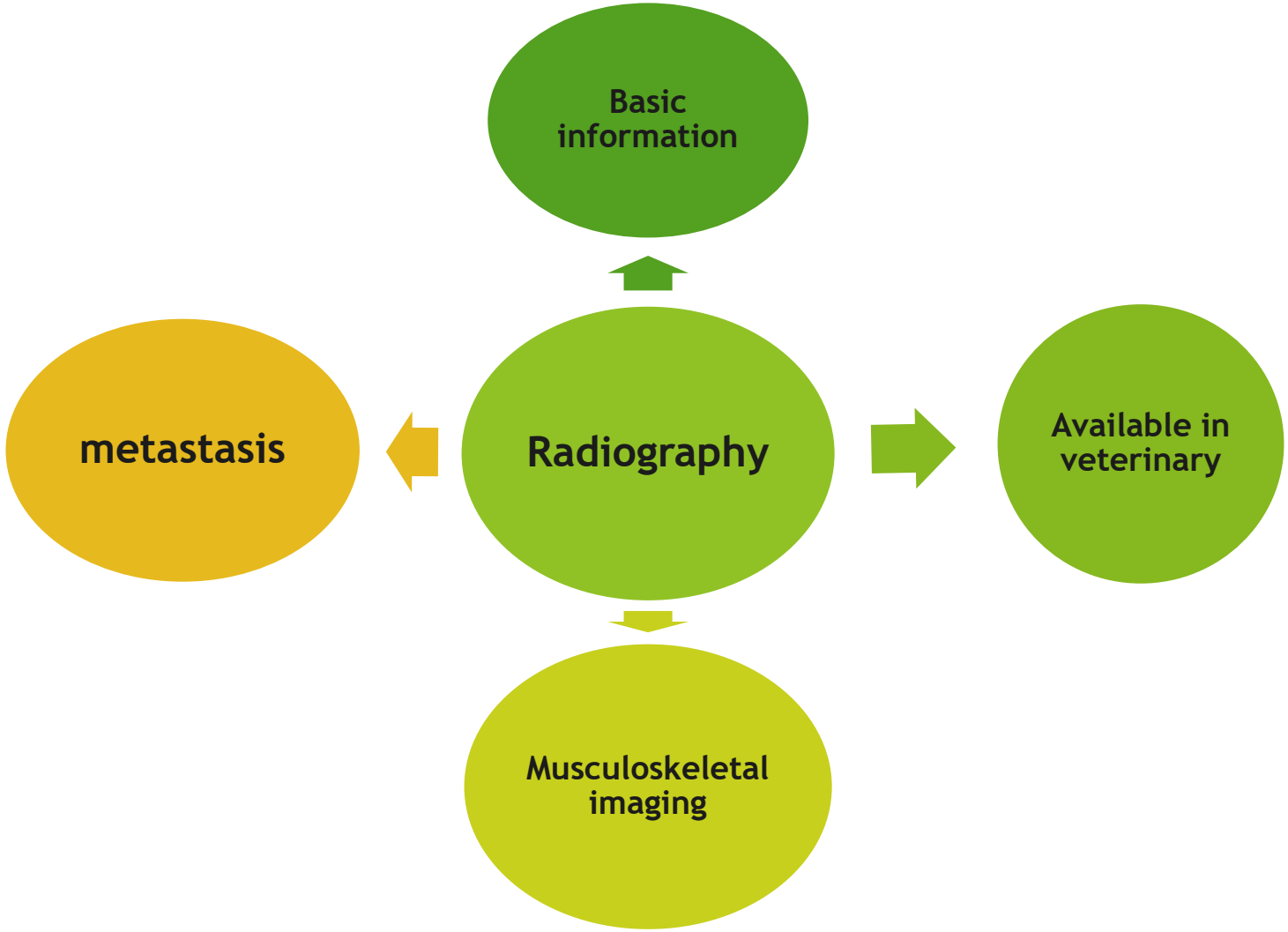
Role of Diagnostic imaging in oncology

- Early Diagnosis
- Staging
- Monitoring

- Radiography
- Ultrasonography
- Computed Tomography
- MRI
- Nuclear medicine

- Anatomical
- Functional
- molecular

Radiography: conventional method but useful and available



Ultrasonography: a foundation in veterinary imaging

- **Advantages:**
- Available
- More sensitive than radiography especially for lesion localization
- Using for fine needle aspiration and biopsy
- Colour doppler mode : Vascularization

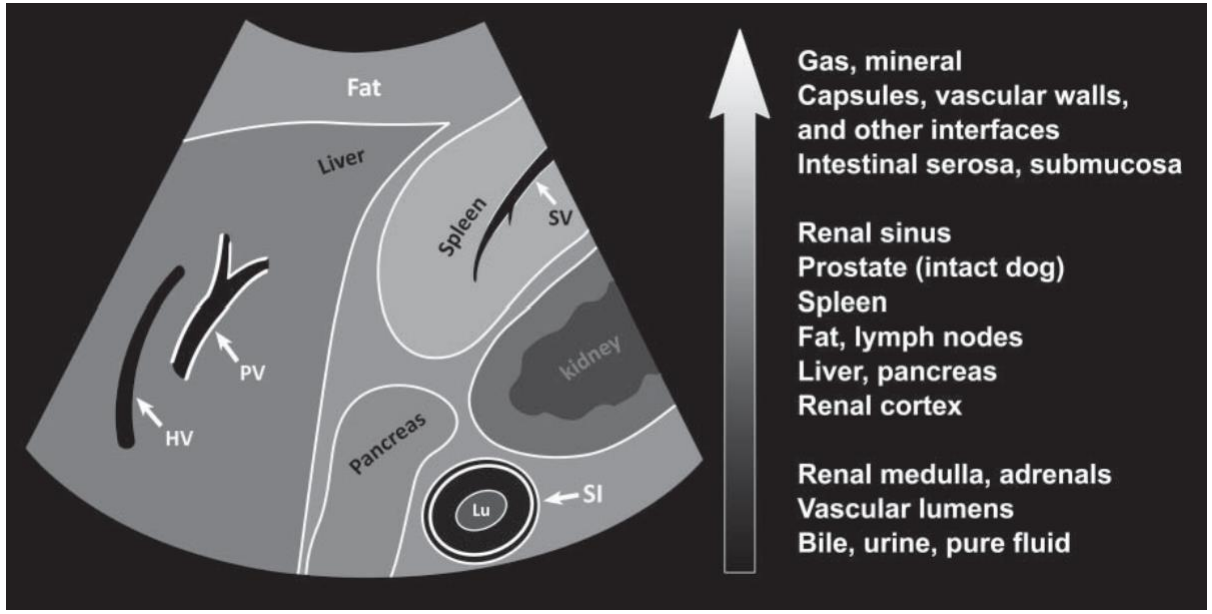
Ultrasonography: a foundation in veterinary imaging

- **Disadvantages:**
- Poor sensitivity for parenchymal lesions (the only exception is for GI tract wall changes)
- Can not differentiate malignancy from benign even with doppler mode
- Not providing sectional imaging
- Not able to show entire extent of the lesion

- Ultrasound is still used for exploration and also monitoring the therapy in veterinary medicine
- Panorama imaging in newer US mchine

Ultrasonographic fundamentals

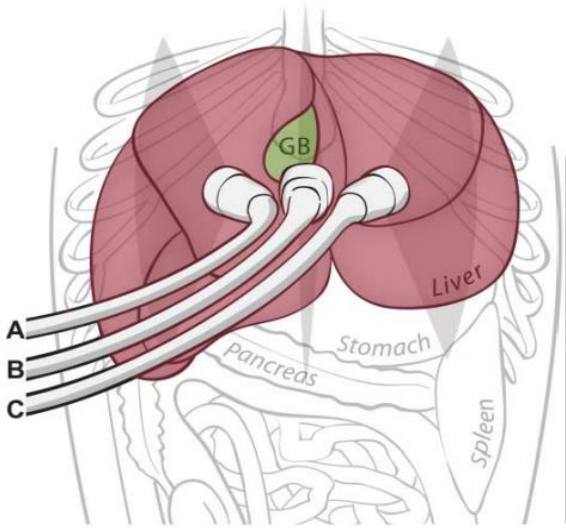
- ✓ Echogenicity
- ✓ Hypoechoic
- ✓ Hyperechoic
- ✓ Anechoic

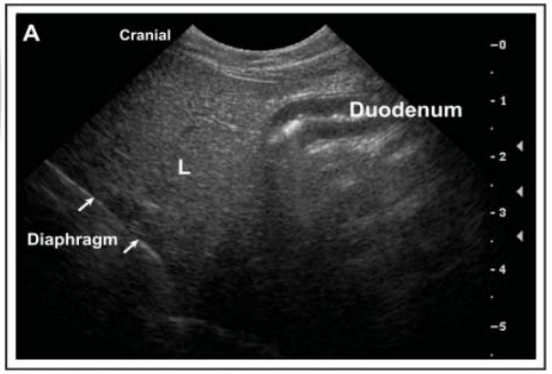


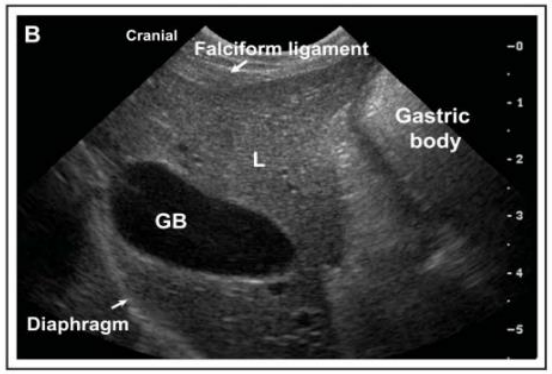
Tissue appearances in ultrasonography

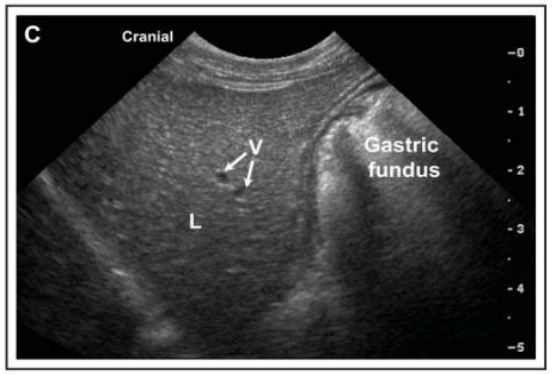
Panoramic image

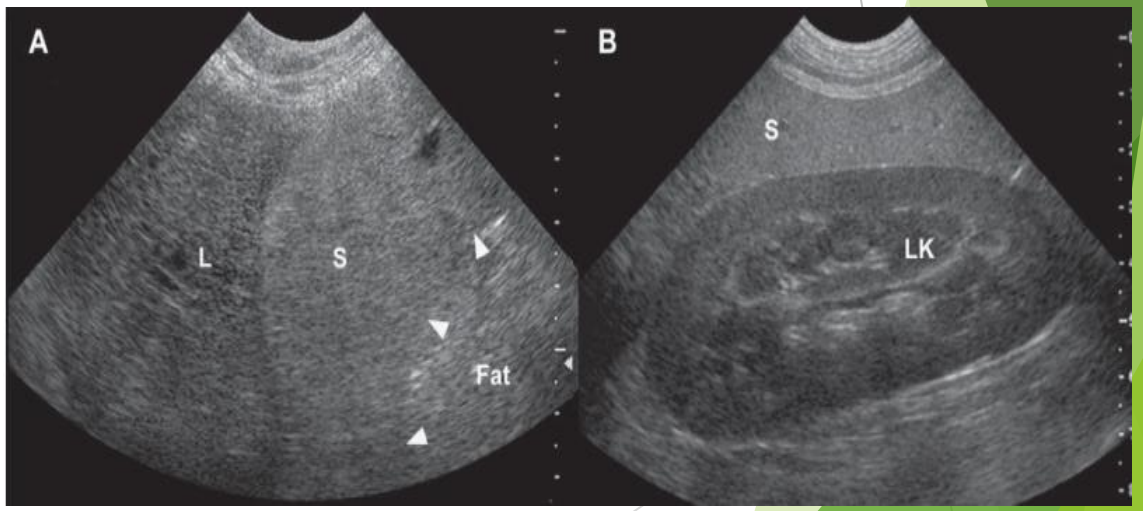
Normal US examination



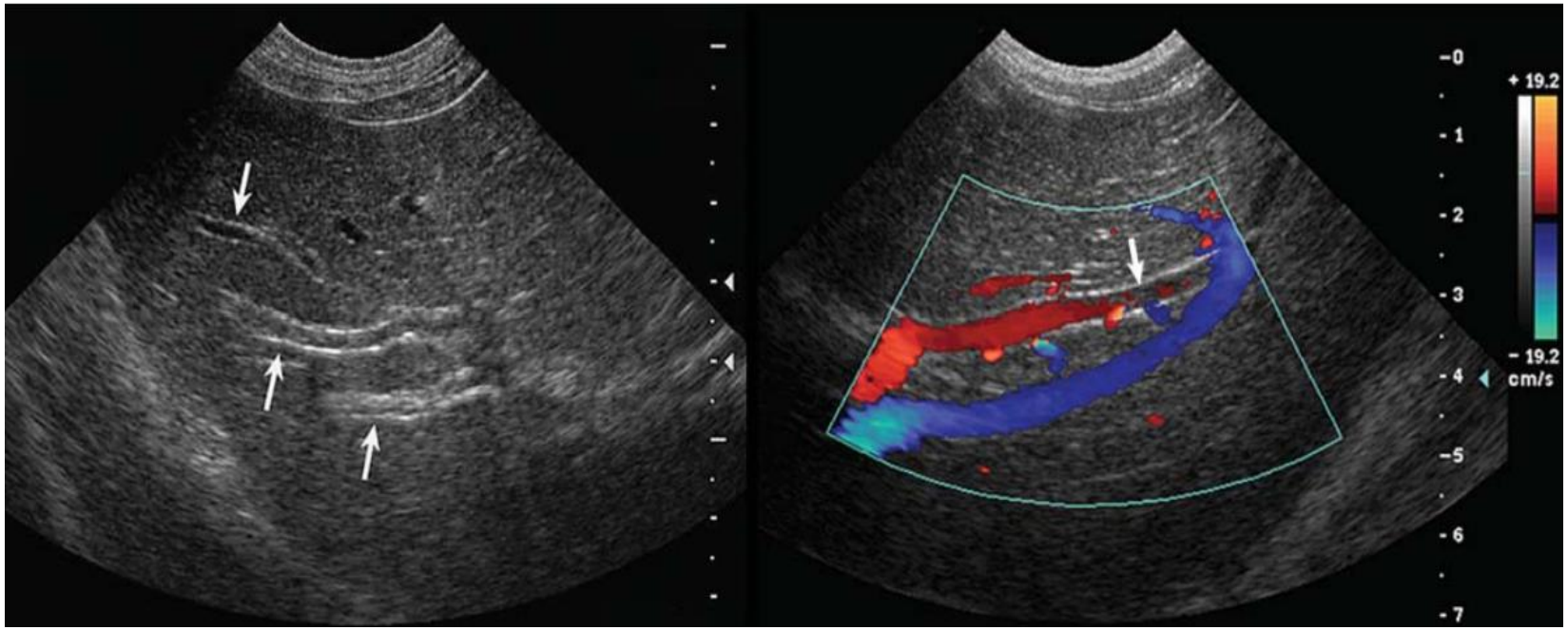








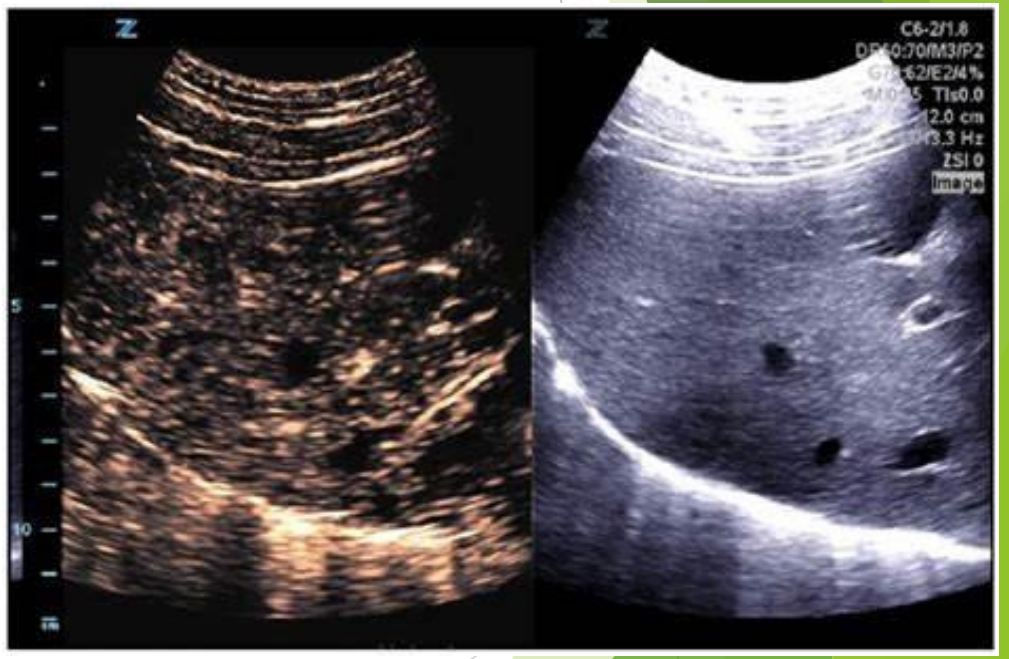
CFD examination



US guided FNA

Contrast-enhanced Ultrasonography

- Name of contrast media: Microbubble contrast agent
- Techniaque: based on hyperechoic appearance of gas in US / injected to a peripheral vein and evaluate the blood supply of the tissues based on increase of echogencity
- Used for characterisation of hepatic, splenic and renal lesions
- Differentiate malignant from benign lesions: because it shows blood supply or angiogenesis like colour doppler

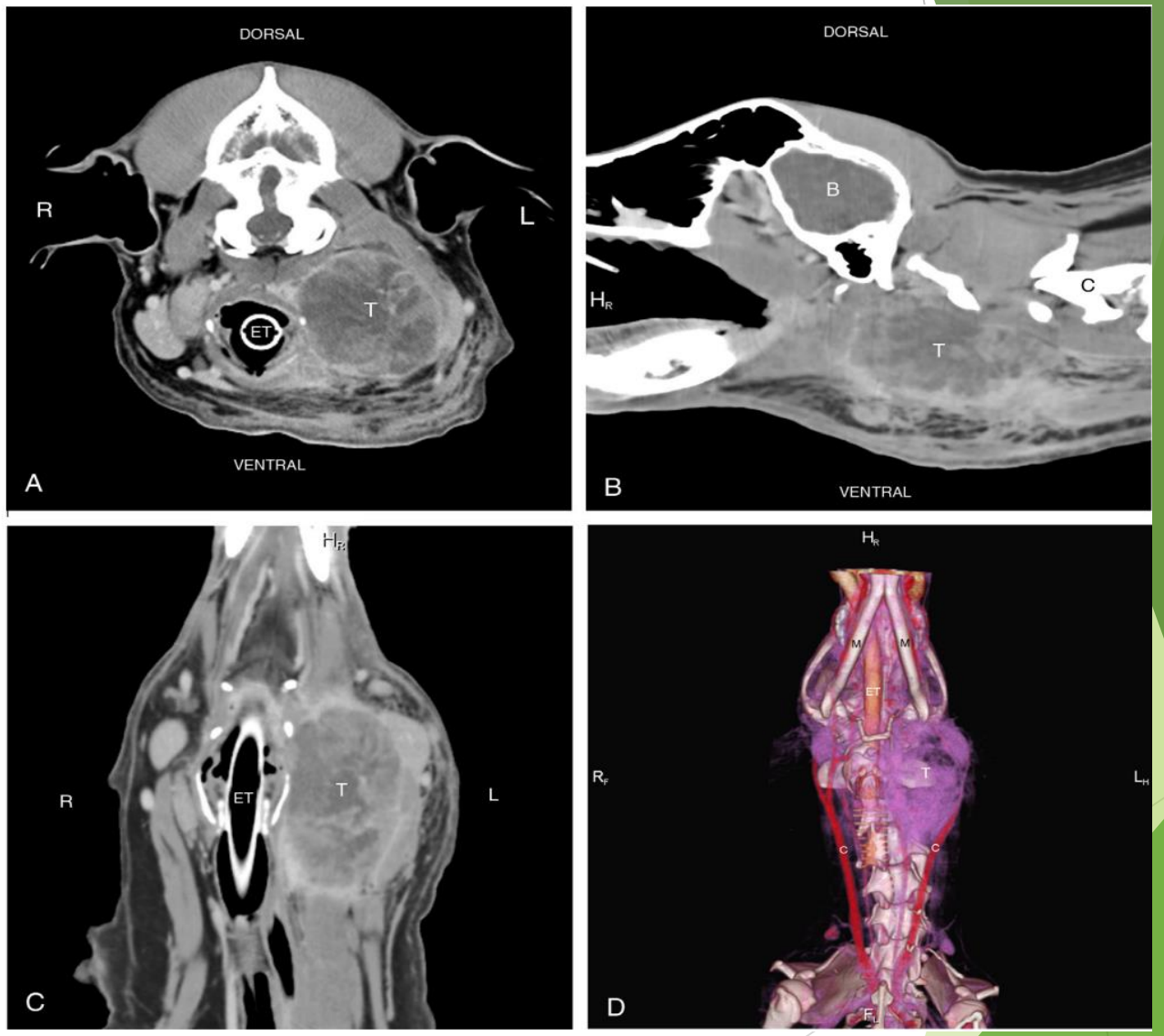


Computed tomography: cross-sectional imaging

- Cross sectional imaging
- 3D reconstruction
- Blood supply with contrast CT scan and angiography (venous and arterial phase)
- Able to differentiate different soft tissues and so diagnosis of the origin of a tumour
- CT number
- The most sensitive technique for pulmonary lesions
- Most sensitive for lymphadenopathies
- Possibility of biopsy under the guide of CT
- Application for External beam Radiothrapy with localizing the tumour

A

B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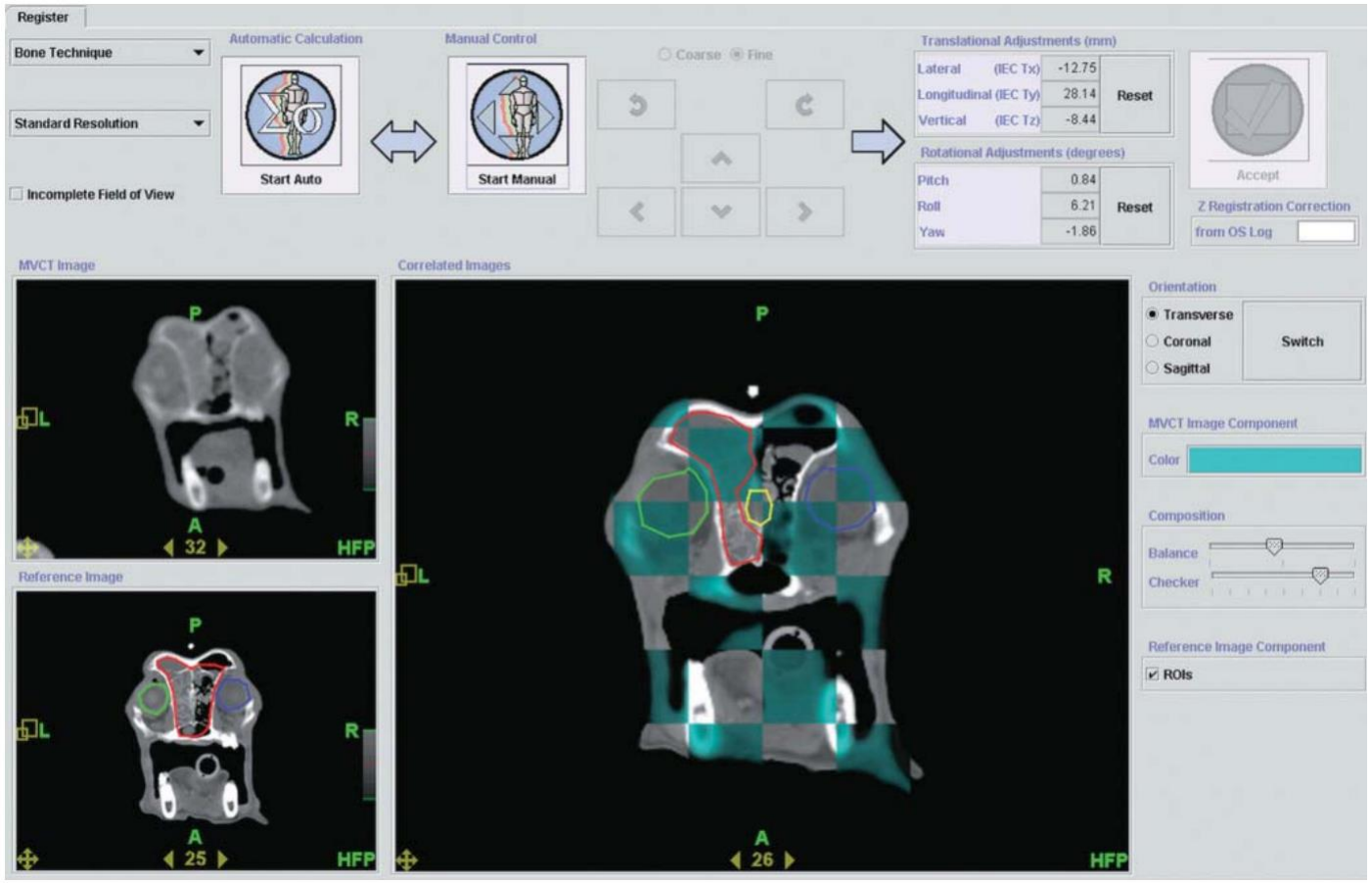
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Longitudinal (IEC Ty) 28.14
Vertical (IEC Tz) -8.44
Reset
Rotational Adjustments (degrees)
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Roll 6.21
Yaw -1.86
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ROIs

Application of CT scan for different tumours

- **Intracranial tumours**
  - biopsy
  - radiotherapy
  - monitoring
- **Intranasal**
  - Detection
  - radiothrapy
  - Staging and lymph nodes involvement
- **Skull and oral tumours**
  - biopsy
  - radiotherapy
  - monitoring
- **Lung tumours**
  - Primary or metastatic
  - 93% sensitivity for detection of metastasis
  - Staging and lymph nodes involvement
  - Tracheobronchial lymph nodes
- **Abdominal tumours**
  - The origin
  - vascularization
  - Invasion to vessels
- **Integumentary tumours**
  - Extent of the tumours
  - lipoma
  - Injection-site sarcoma

Safety Concerns about CT scan

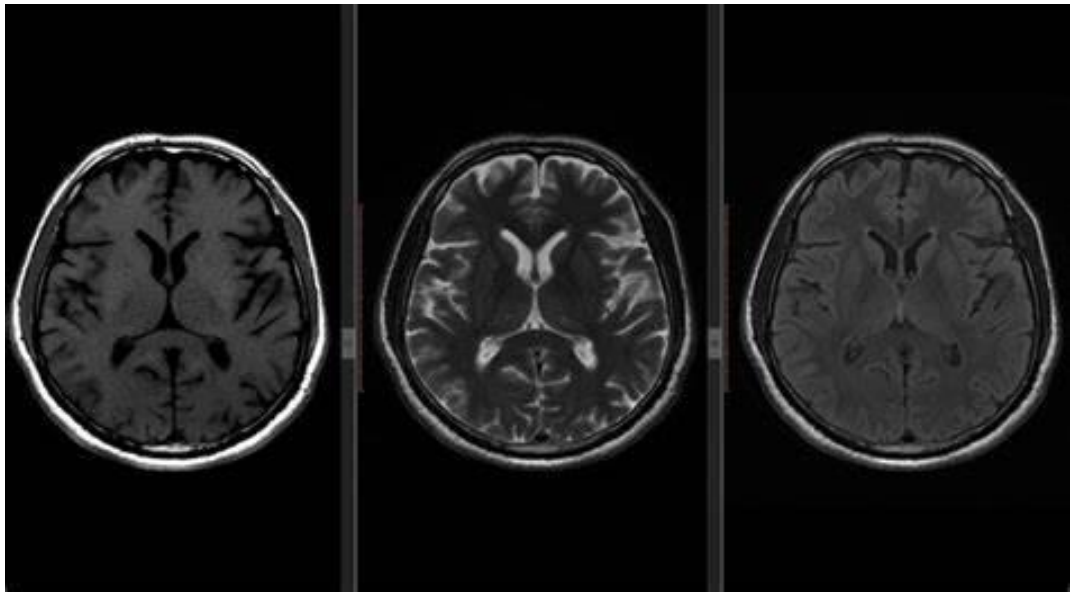
- Ionizing radiation
- Optimizing the exposure technique

MRI: cross-sectional, non-ionizing imaging

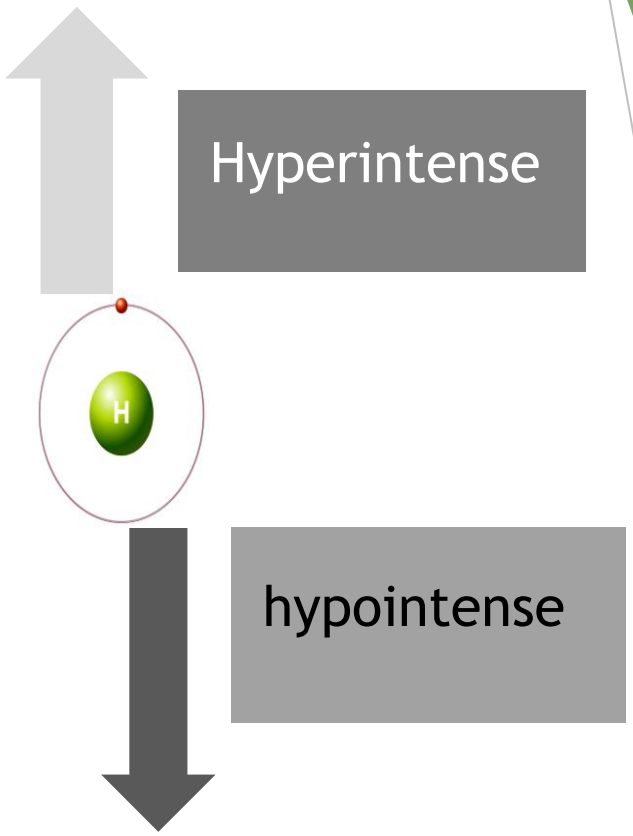
- MRI images depend on the chemical structure of the tissues: hydrogen atoms in a tissue
- Cross sectional imaging
- Different sequences for high contrast resolution for differentiate soft tissues
- STIR: short time inversion recovery (for detection of the tumours beside the fat tissue)
- FLAIR: fluid attenuation inversion recovery (for detection of perilesional edema)

- Post contrast imaging: Gadolinium

MRI fundementals



T1 T2 PD



- Intensity
- Hyperintense
- Hypointense

MRI imaging

MRI of brain, spinal and paraspinal tumours

- Preferred modality
- High correlation with histopathology

MRI of cervical, orbital and retrobulbar tumours

- Superior for soft tissue tumors

Abdominal tumours

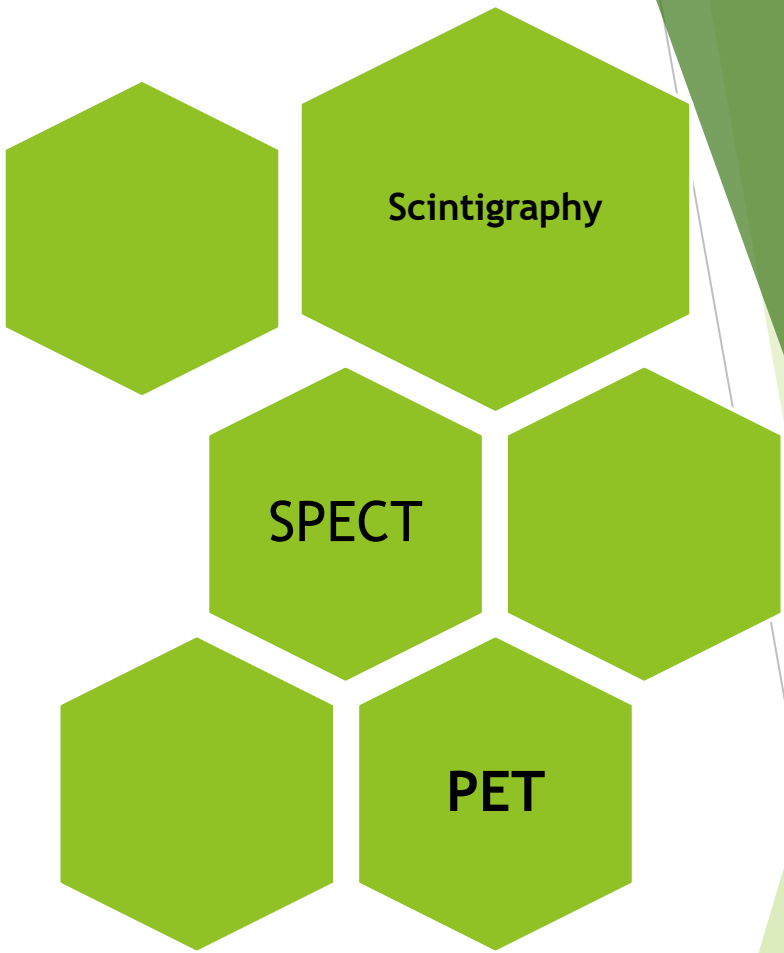
- Spleen and liver lesions, 95% accuracy

High accuracy for detection of the lesion size in osteosarcoma

MRI disadvantages

- Cost of equipment
- General anaesthesia
- Expert technicians

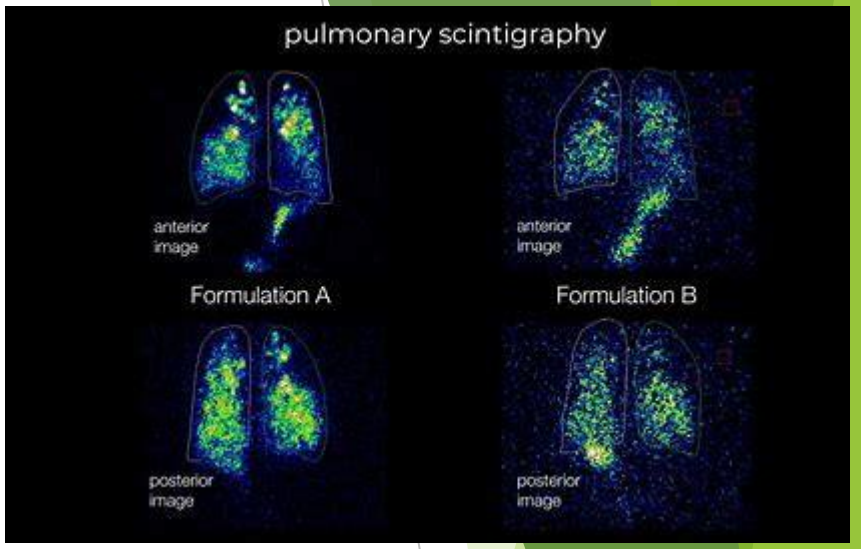
Nuclear imaging



- Radiopharmaceuticals / radionuclides
- Detecting by gamma camera
- Physiologic activity
- In combination with CT and MRI for anatomic data

Scintigraphy

- Provide 2D images
- Static or dynamic
- Dynamic studies can be used to calculate uptake and kinetics of the radioactive agent to define distribution, excretion, or flow dynamics properties
- Technetium99m : metastable compound which is decayed with gamma ray emission



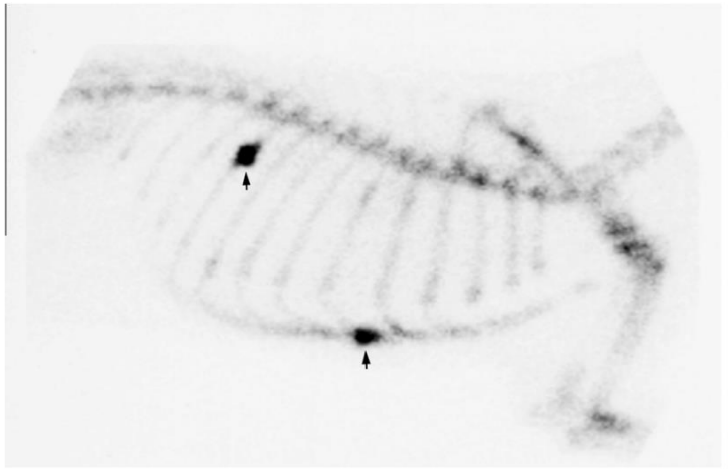
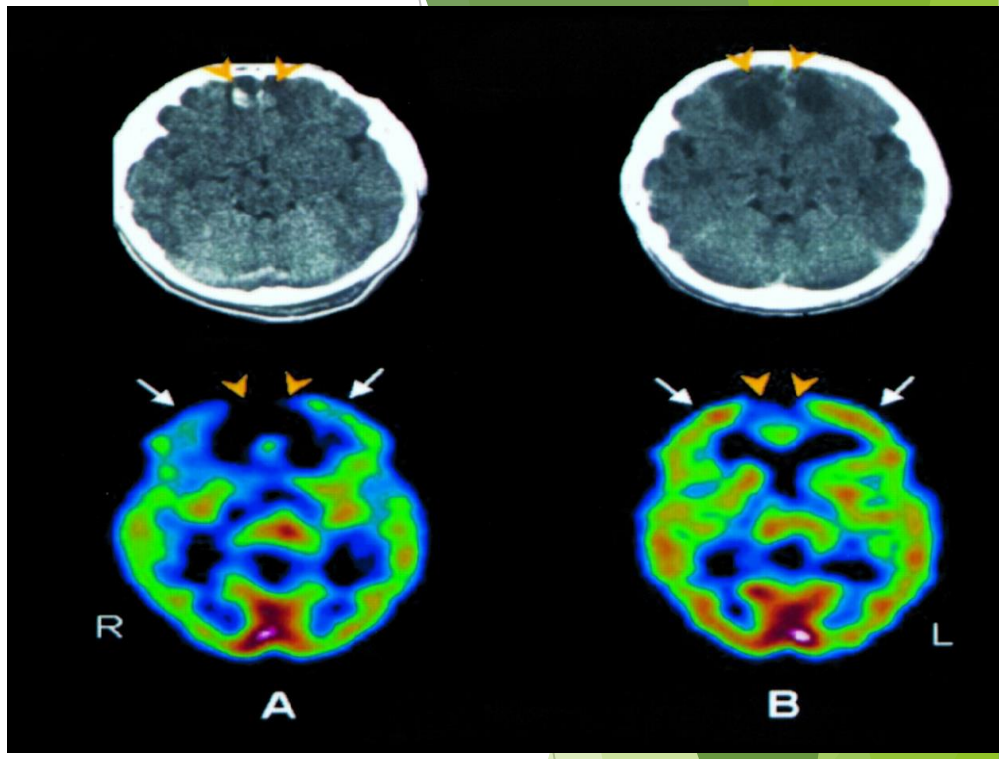


Fig. 10. In a study of 399 dogs presenting with osteosarcoma, 7.8% had a second skeletal lesion consistent with an osteosarcoma metastasis detected on ^{99m}Tc-HDP nuclear scintigraphy (Jankowski et al., 2003). Presented is a representative bone scintigraphic scan with two apparent rib lesions (arrows) that were confirmed as osteosarcoma metastases. The dog head is to the right, dorsal is at the top of the image. (Image courtesy of Washington State University).

Single photon emission computed tomography: SPECT

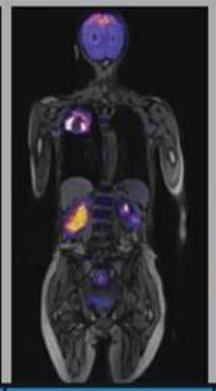
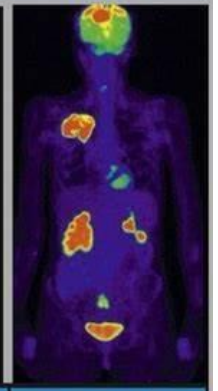


- Provides 3D imaging
- The principal advantage of SPECT is a more accurate image of the distribution of the agent within the field
- Identifying the target of interest within a tumor or organ could select candidates for targeted treatment and guide therapy decisions in the future.
- SPECT imaging has been used to evaluate tumor metabolism in dogs with cancer

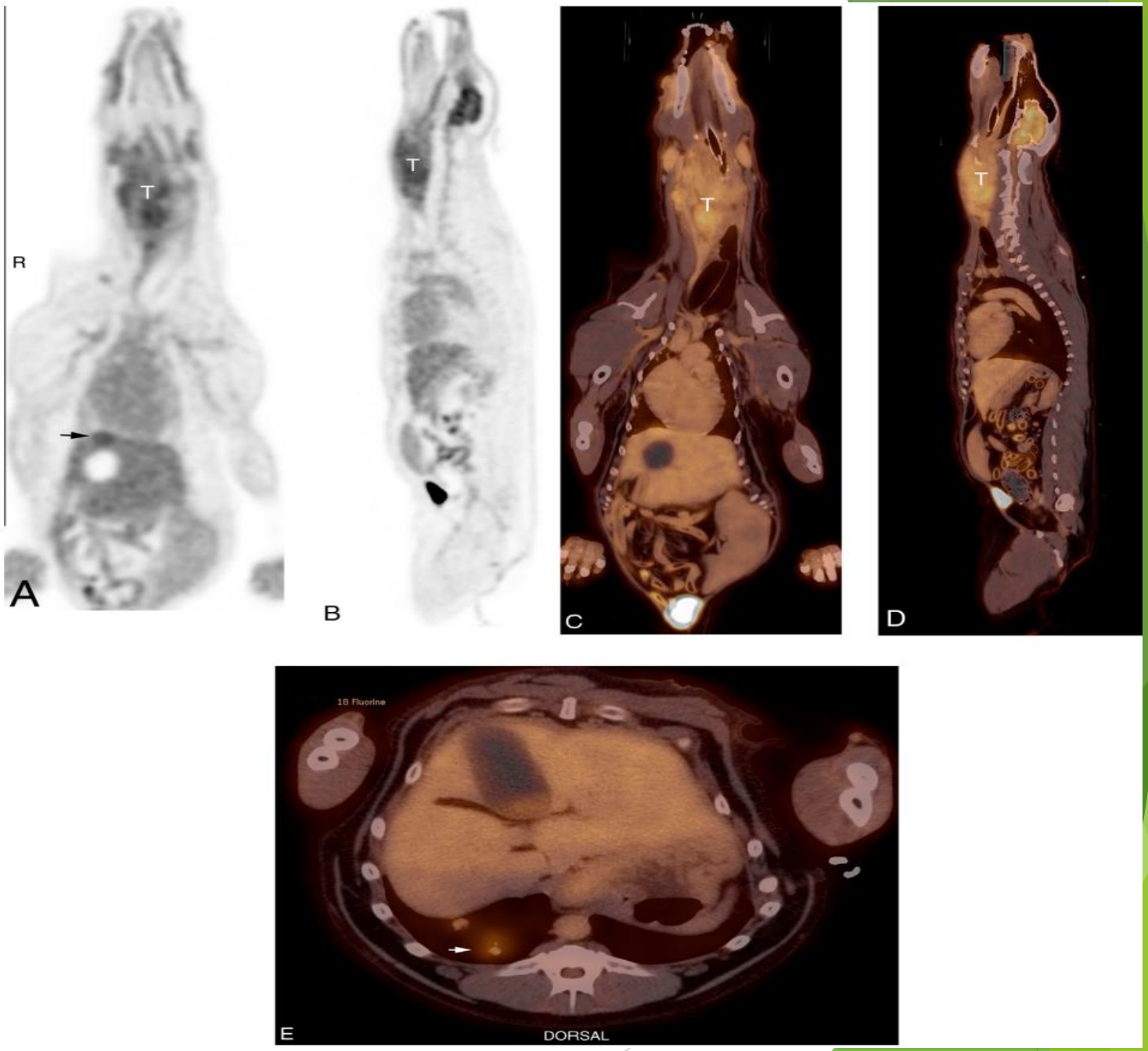
Positron emission tomography (PET)

- Routine method in human cancer detection, staging and monitoring
- Mostly used for experimental goal in veterinary
- In this technique the positron particle emitted high-energy photons during annihilation
- Positron
- High resolution in this method
- based on increased glucose transport and metabolism in tumors compared with surrounding tissues

- The first FDA-approved chemical for this method was F-FDG relies on excessive glucose utilization by cancer to localize in tumors, but because of inflammatory tissues also use this agent, there is possibility of false-positive result
- In human oncology, 18F-FDG imaging is indicated for staging a variety of tumors including breast cancer, hepatocellular carcinoma, lung tumors, head and neck carcinoma, brain tumors, and many sarcomas
- Some human tumors, such as prostate cancer, cannot be imaged well with 18F-FDG
- Imaging results with 18F-FDG in dogs are very similar to those in humans
- fluorine-18, CU69

BOOKMERILAB.COM	MRI	CT	PET
			
Tech	Magnets + radio waves	X-rays (3D)	Radiation traces with CT Scan
Detect	Soft Tissue, Tendon, Ligament Brain	Bony structure and blood vessels	Cancer Heart Brain
Procedure Time	30 min	5 - 10 Min	60 - 90 Min

- A,B: Pet
- C,D,E: PET CT



Practical points in PET

- Use of a sedative premedicant with cage confinement are recommended after FDG injection to minimize aberrant uptake of FDG in skeletal muscle
- General anesthesia

- Uptake of FDG as a marker of glucose metabolism can be semiquantified using the standardized uptake value (SUV), which is used to determine the relative significance of uptake
- The SUV is obtained by quantifying the radioactivity within a region of interest (ROI) placed over the lesion, taking the ratio of the ROI value (in microCi/mL) to the injected dose, divided by the patient's body weight

$$SUV = \frac{\mu Ci/mL \text{ within ROI}}{\text{total } \mu Ci \text{ injected}/\text{weight}}$$

- SUV greater than 2 is considered suspicious for malignancy
- A tissue biopsy is still needed for definitive diagnosis, but a PET scan can be important in decision making for patients having untreated or recurrent cancers.

Clinical application of PET

- PET imaging using FDG has become a routine part of the diagnostic evaluation of certain human cancers. Tumor cells have increased uptake of glucose; therefore, even though FDG is nonspecific for cancer, it is used for whole-body assessment of patients having suspected or confirmed neoplasia
- Numerous studies demonstrate the accuracy and value of PET in staging known neoplastic disease
- PET is also uniquely suited to detect recurrent disease and distinguish it from posttreatment fibrosis, scar, or necrosis.

- Lack of available equipment and high cost of PET radiopharmaceutic agents have limited the use of PET as a diagnostic tool in veterinary oncology

Artificial intelligence (AI)

Contents lists available at ScienceDirect

Computational and Structural Biotechnology Journal

journal homepage: www.elsevier.com/locate/csbj

Artificial intelligence in skeletal metastasis imaging

Xiying Dong [a,b,c,d], Guilin Chen [a,b,f], Yuanpeng Zhu [a,b,f], Boyuan Ma [h], Xiaojuan Ban [h], Nan Wu [a,b,g], Yue Ming [e,*]

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EClinicalMedicine

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Research Paper

Artificial intelligence performance in detecting tumor metastasis from medical radiology imaging: A systematic review and meta-analysis

Qiuhan Zheng[a,b,1], Le Yang[a,b,1], Bin Zeng[a,b], Jiahao Li[a,b], Kaixin Guo[a,b], Yujie Liang[a,b,#,*], Guiqing Liao[a,b,#,*]

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Research in Veterinary Science

journal homepage: www.elsevier.com/locate/rvsc

Artificial intelligence in veterinary diagnostic imaging: Perspectives and limitations

Silvia Burti [a,*], Tommaso Banzato [a], Simon Coghlan [b], Marek Wodzinski [c,d], Margherita Bendazzoli [a], Alessandro Zotti [a]

AI

- AI software for detecting pulmonary nodules and mass based on CT images with accuracy about 69% and also radiography with error rate about 16 % besides radiologist

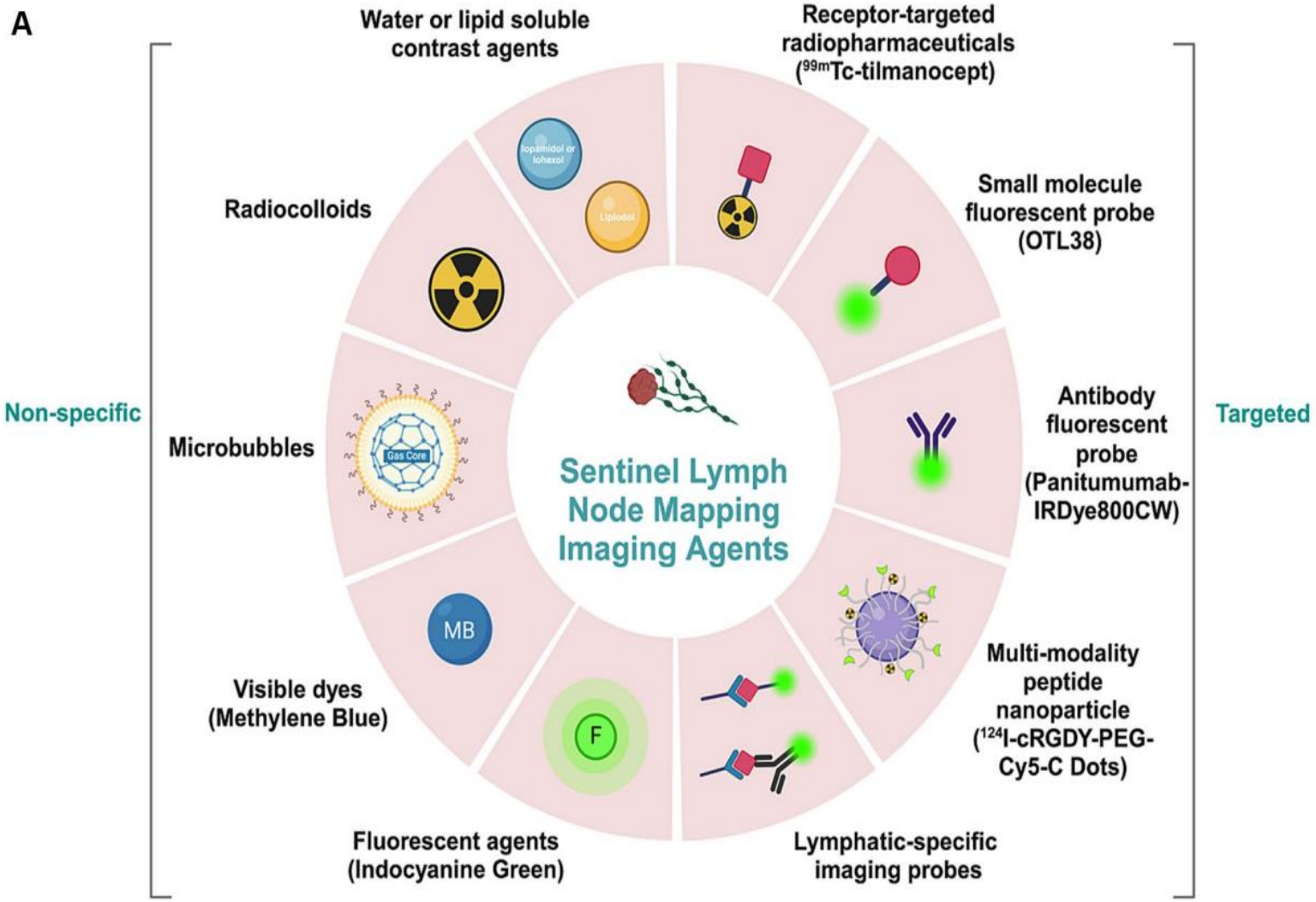
- AI-based models, in particular deep learning models, could act as effective supports in the evaluation of medical images for both specialized radiologists and general practitioners. Nevertheless, these technologies should not replace veterinary experience and knowledge.

Sentinel lymph node mapping

- What is sentinel lymph node: the first lymph node which drains the primary tumour
- The status of the invasion to the sentinel lymph node is important for staging and pre-treatment decisions
- Its more important for solitary and more superficial tumors like mammary gland tumors, skin tumors and oral and cervical tumors

- 2 types: preoperative and intraoperative

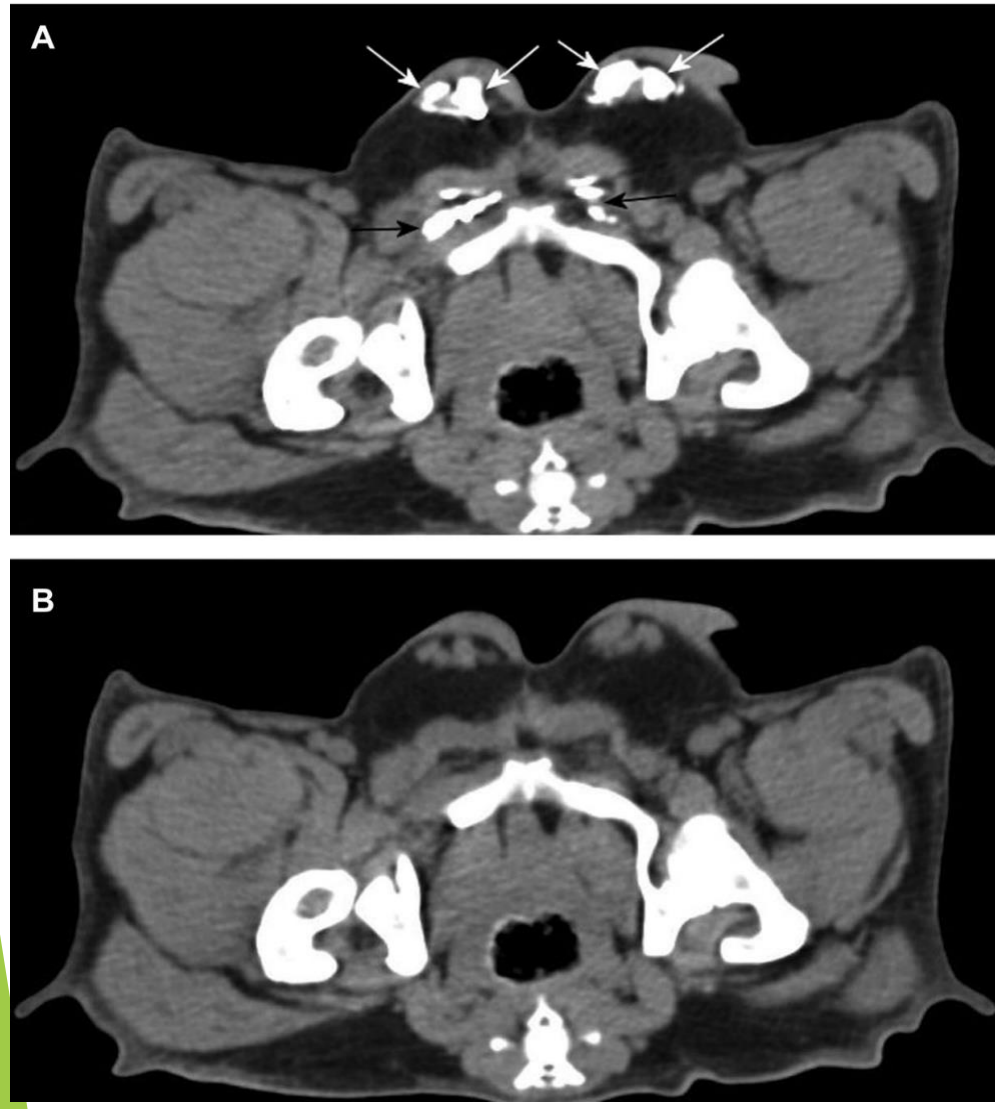
Sentinel lymph node mapping



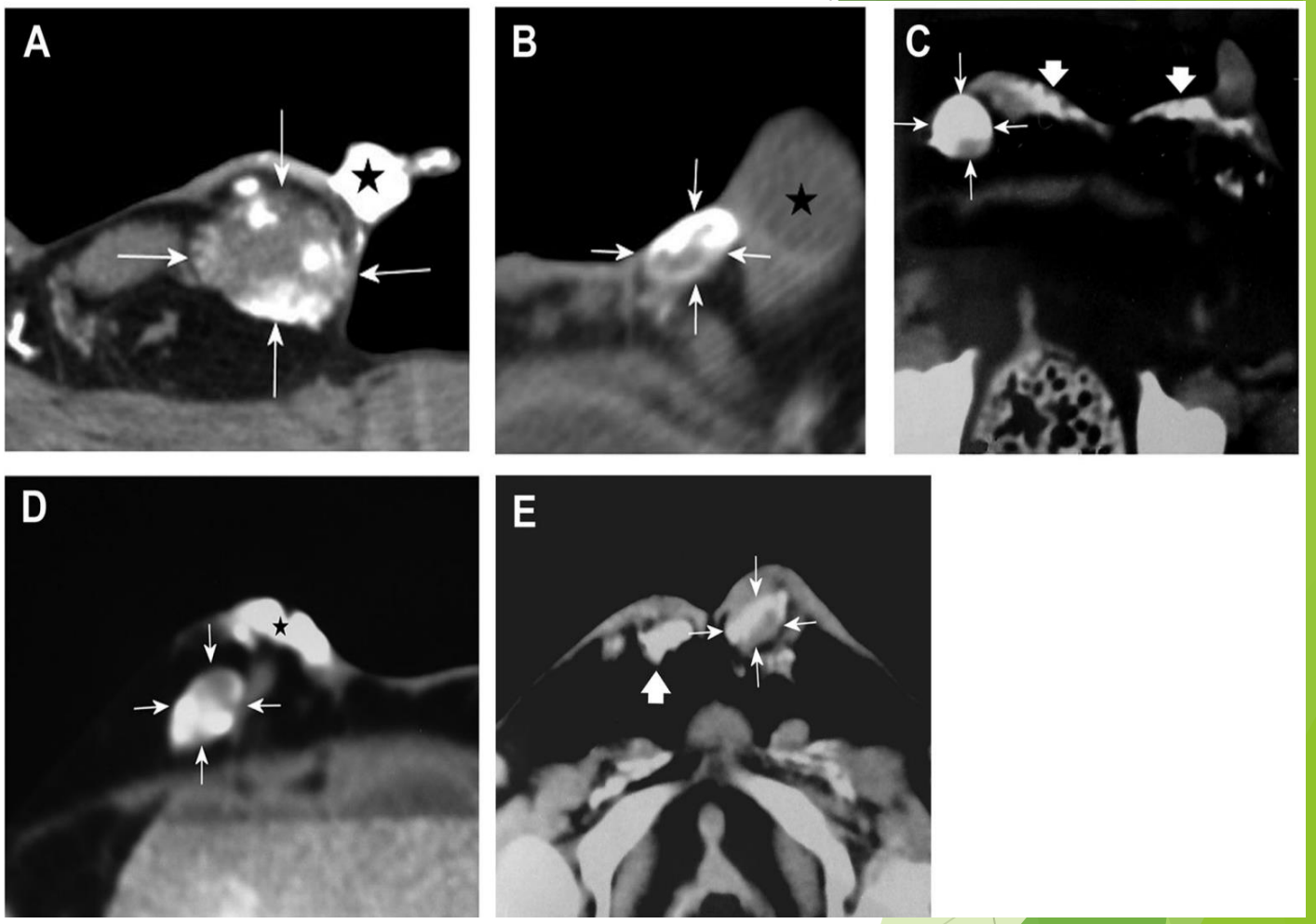
Practical point

- Lymphoscintigraphy: injection of the radionuclides near the tumour and detection with gamma camera
- Computed tomography + indirect lymphography (CTLG): injection of the water-soluble agent or fat based agent in peritumoral region and checking the enhancement pattern of the lymph nodes
- Radiographic lymphography
- CEUS: contrast-enhanced US

CTLG



Normal lymphogram



Abnormal lymphogram

Radiographic lymphography

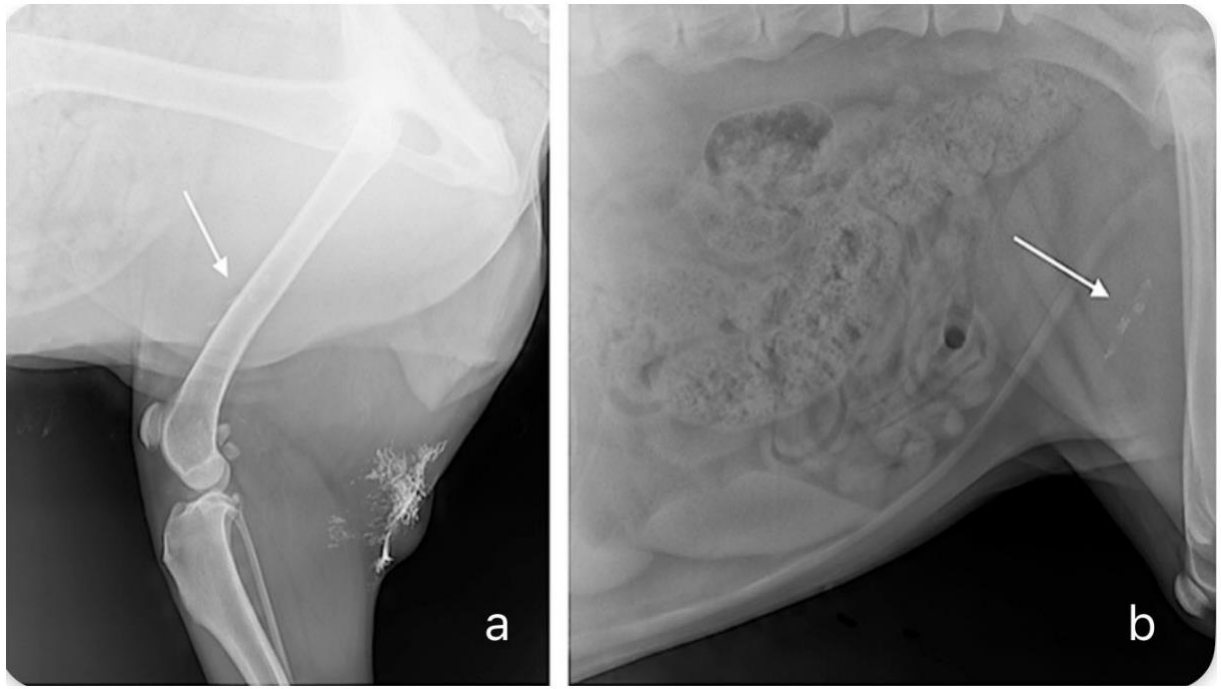


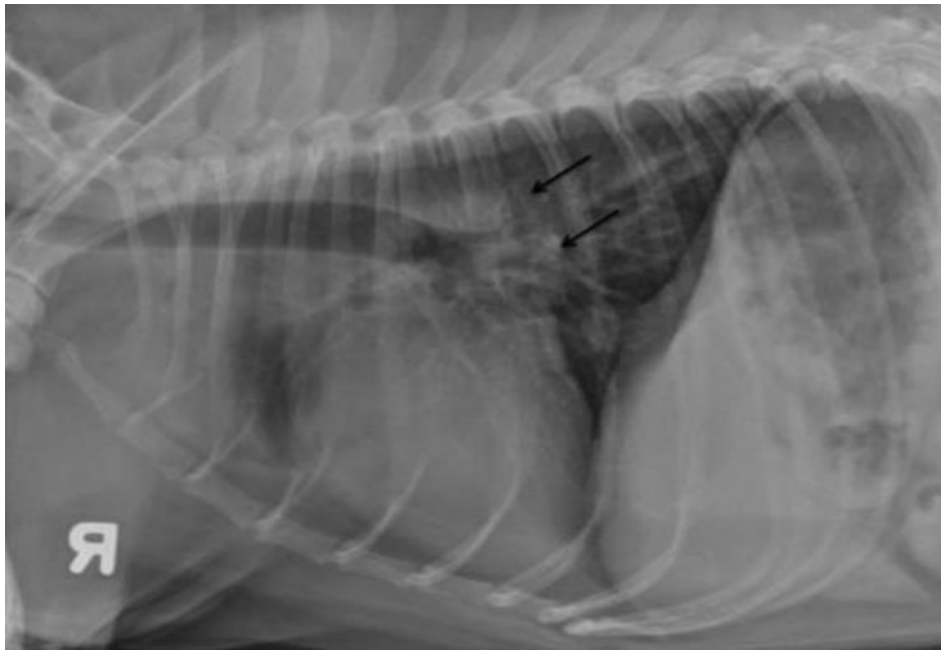
Figure 1. Radiographs presenting indirect lymphography 24 h after the peritumoral injection of Lipiodol in a dog with a tumor located in the popliteal region. (**a**) Lateral radiograph of the caudal part of the abdominal wall and popliteal region. A shadow in the popliteal region corresponds to the site of the injection of the contrast agent. The arrow indicates a superficial inguinal lymph node. (**b**) A radiograph that better visualizes the superficial inguinal sentinel lymph node (arrow).

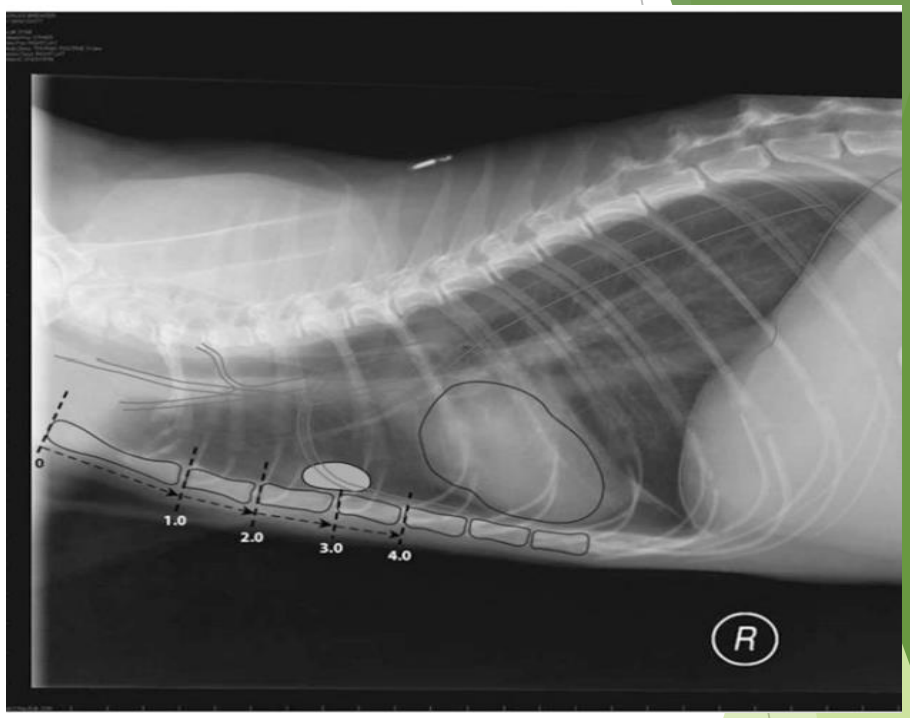
Tumoral Staging: key role of imaging

- Local invasion
- Distant metastasis
- Sentinel lymph node detection
- Thoracic Xray + abdominal Radography
- Whole body CT scan

Thoracic Lymph nodes evaluation with radiography

- Sternal lymph nodes
- Tracheobronchial lymph nodes





Mandibular Lymph nodes: CT and US

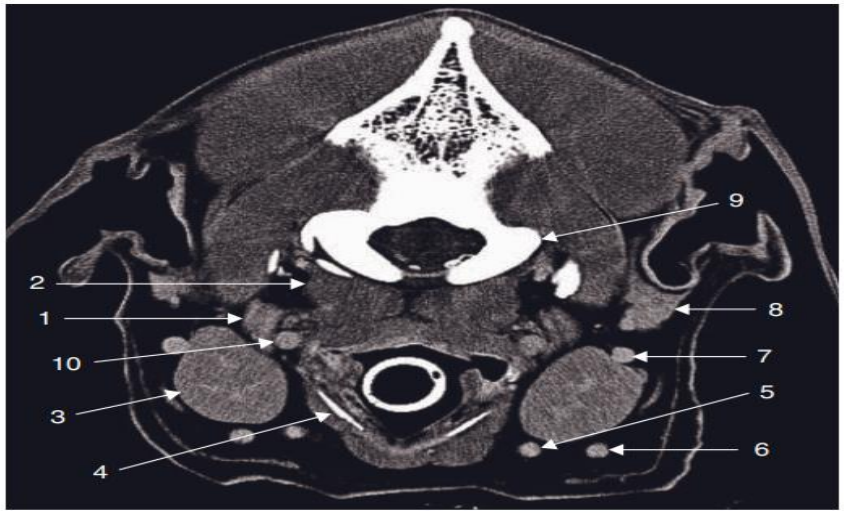
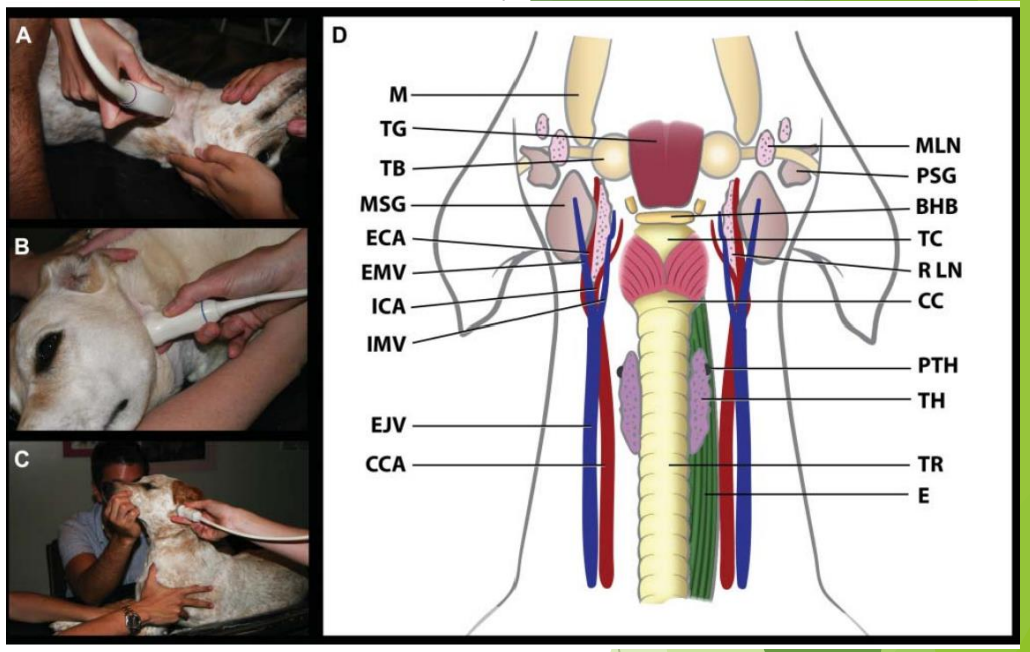
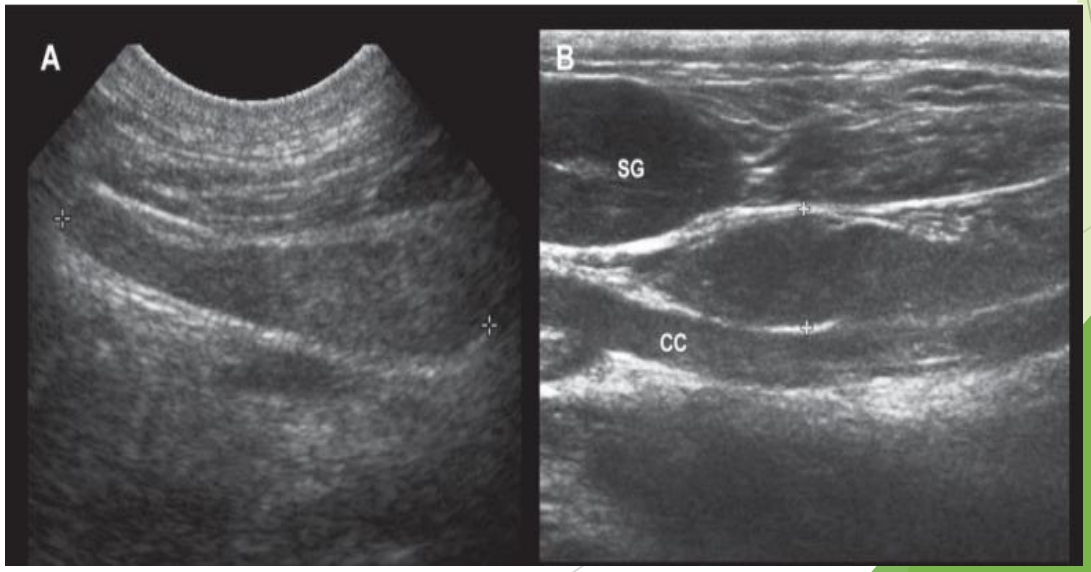


Figure 17.2 CT anatomy of the medial retropharyngeal lymph nodes in a dog. Post-contrast transverse CT image obtained caudal to the digastric muscles and caudal to the mandibular lymph nodes. 1 = right medial retropharyngeal lymph node; 2 = longus capitis m.; 3 = right mandibular salivary gland; 4 = thyroid cartilage; 5 = lingual vein; 6 = linguofacial vein; 7 = retromandibular vein; 8 = parotid salivary gland; 9 = occipital condyle; 10 = external carotid artery.

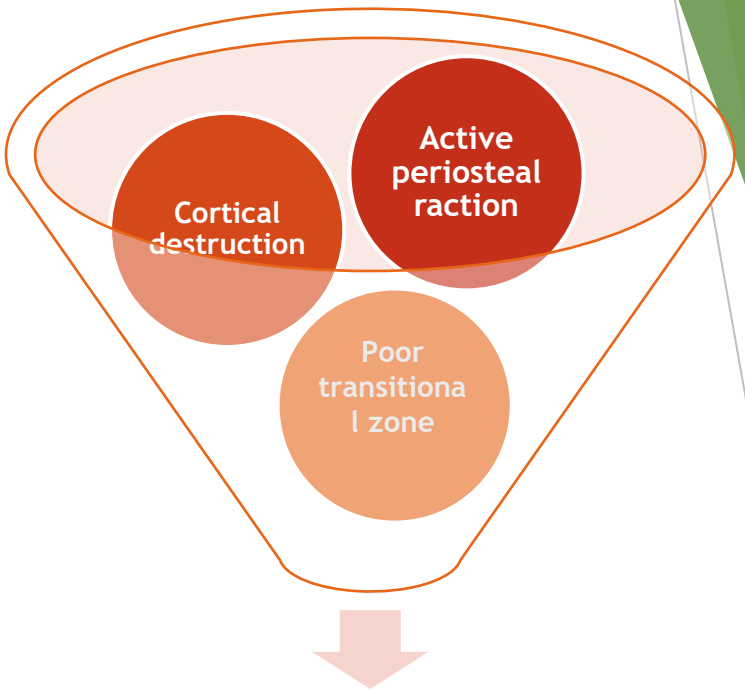




Diagnostic Imaging Characteristics of the Most Common Malignancies in Small Animals

Presented by Dr. Saghar Karimi
Assistant professor of diagnostic imaging at Shiraz university

Primary bone tumours



Aggressive bone lesion

Age
- Old but it can be in youngs

distribution
- monostotic

location
- metaphysis

Osteosarcoma

- The most common primary bone tumour in dogs
- Origin: any where in skeleton but metaphysis of long tubular bones is the most common
- large- and giant-breed dogs
- Common osteosarcoma sites in the forelimb are the proximal humerus and the distal radius (away from the elbow), and in the hind limb, the distal femur and proximal tibia (toward the stifle). Tumors in the distal tibia are also common
- Lytic / proliferative/ mixed

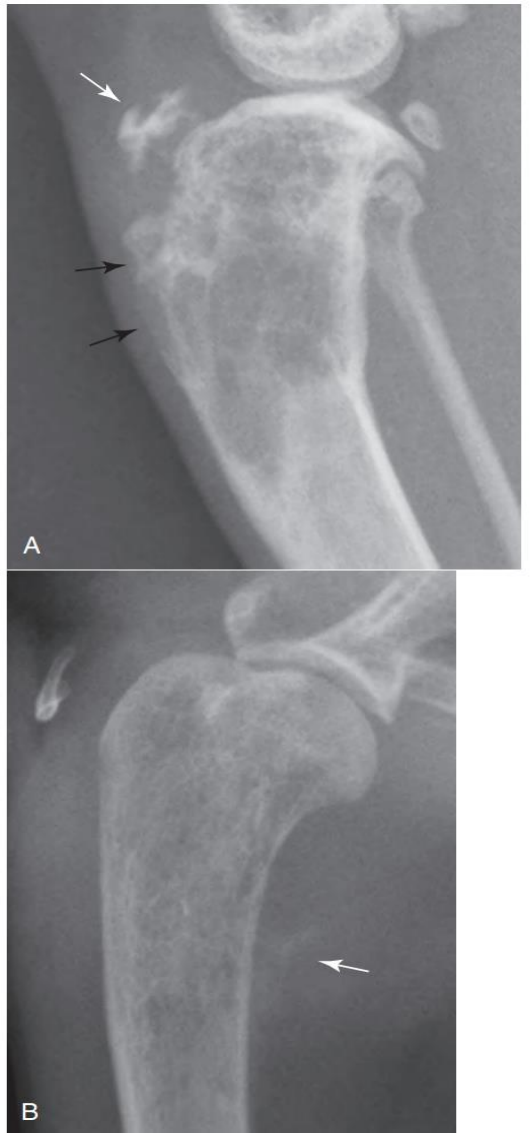
Lytic, proliferative and mixed pattern of osteosarcoma (

Fig. 20.1 Lateral view of the distal radius. There is a lytic osteosarcoma in the craniodistal aspect of the radius. The lesion is aggressive because of the marked cortex destruction and the poorly defined transition zone between the lytic lesion and normal bone.

Fig. 20.2 Lateral view of the femur. A predominantly productive, or sclerotic, osteosarcoma is present in the distal diaphysis and metaphysis. This lesion is composed mainly of smoothly marginated new bone, but the lesion is aggressive because of the lack of a sharp transition zone between normal and abnormal bone. This is a relatively uncommon appearance for an osteosarcoma.

Fig. 20.3 Lateral view of the distal femur. There is mixed lytic and productive osteosarcoma in the distal femoral metaphysis and epiphysis. There is also an active, irregular, periosteal reaction *(black arrows)*. The lesion is aggressive because of the active periosteal reaction and the indistinct transition zone proximally between normal and abnormal bone. The femoral cortex is thin but not effaced completely. A mixed pattern is the most common radiographic manifestation of osteosarcoma.

feline osteosarcoma



Osteosarcoma

Figure 4-38 The "sunburst" appearance of an osteosarcoma. This appearance is not seen in all cases of osteosarcoma.

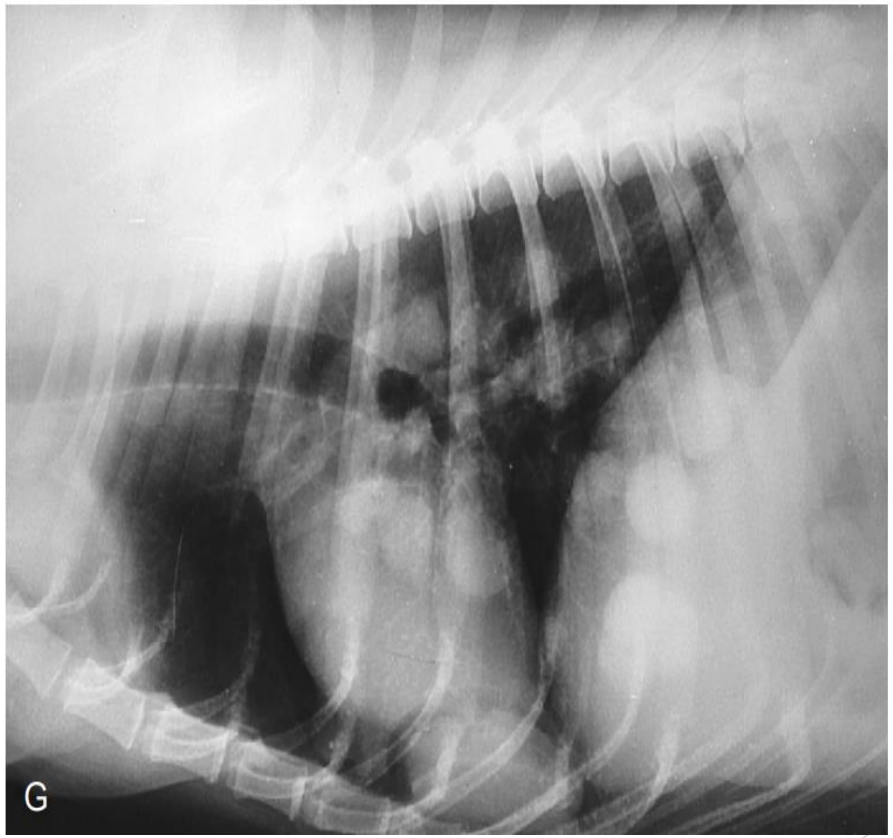
Lung tumors

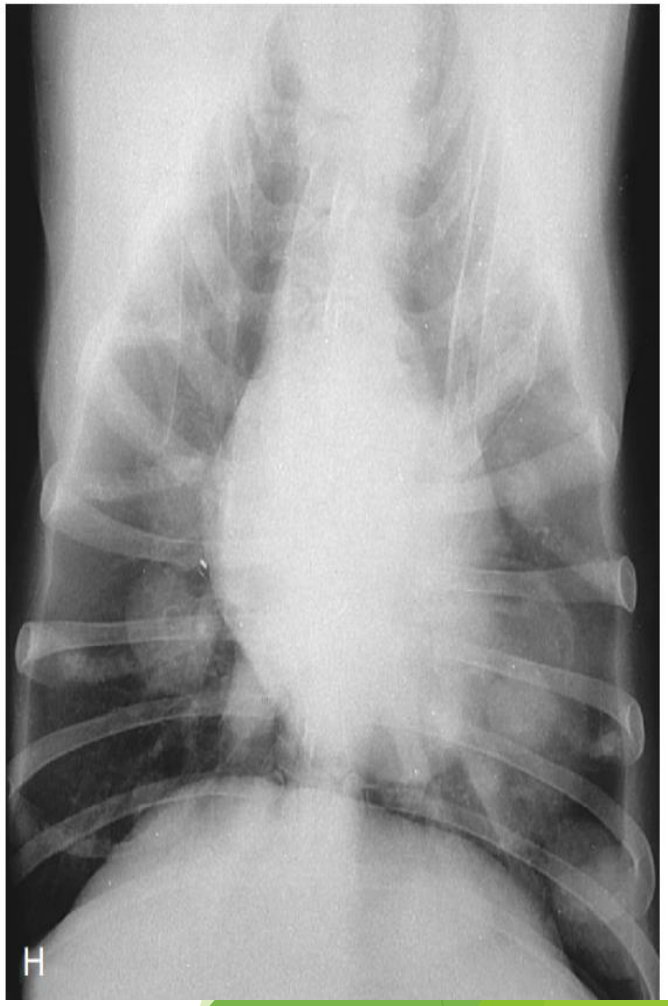
- Primary / metastatic
- In Radiography with different pattern

- Evaluation of lung metastasis: 4 view
- Negative radiographic findings do not exclude the possibility that lung metastases are present.
- The signs of metastatic lung disease are mainly those of an interstitial pattern.
- Multiple, sharply defined soft tissue nodules are the most common manifestation of metastatic lesions
- Metastases of osteosarcoma often show large spherical opacities (“cannonball” configurations)
- Metastases from adenocarcinoma of the mammary gland show small, multiple, sharply defined, widely distributed nodules
- A diffuse interstitial pattern is seen with metastasis of some urinary tract carcinomas
- Multicentric lymphosarcoma may show a reticulonodular pattern with hilar lymph node enlargement and enlarged sternal or mediastinal lymph nodes or both

‘Cannon-ball’ metastasis in a 10y Rottweiler with radius osteosarcoma

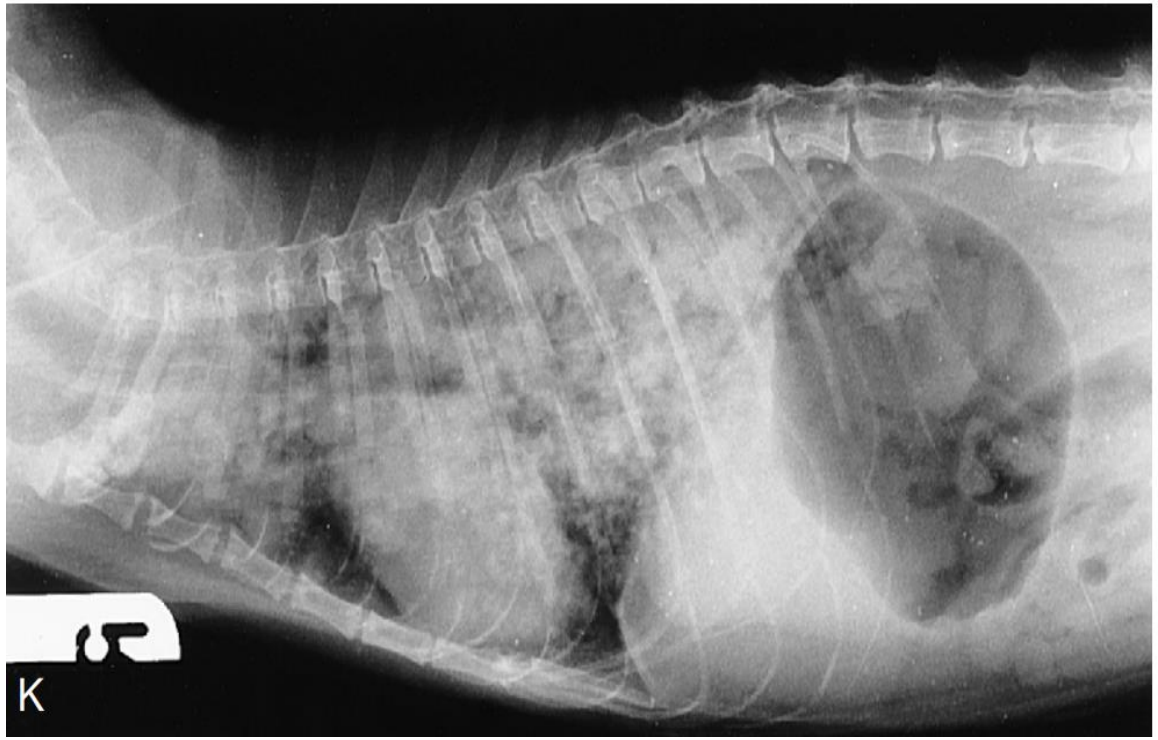
- Multifocal well-define soft tissue opacity mass like Lesion





Reticulonodular pattern: metastasis from a carcinoma

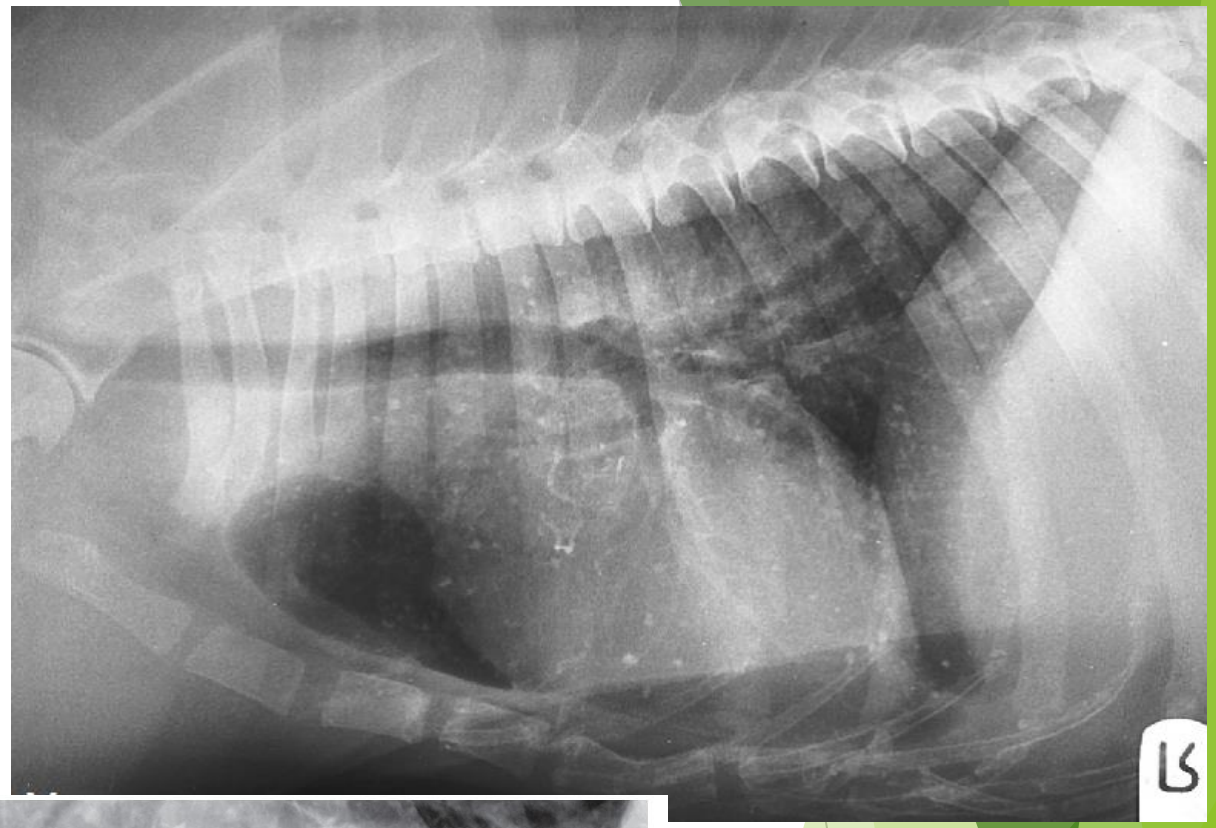
Multiple nodular lesions : metastasis from anaplastic carcinoma

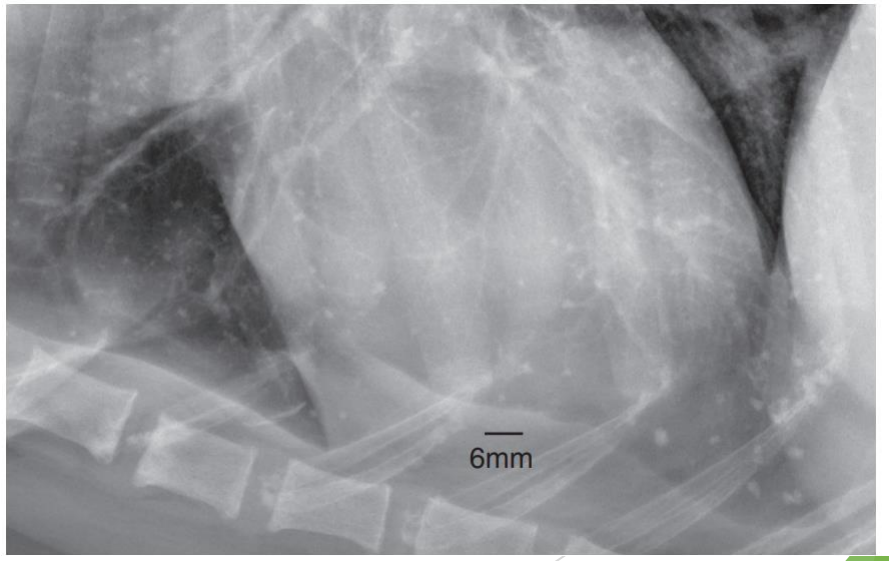


Metastasis from a hemangiosarcoma in a dog

Multifocal mineralized nodules

- What is your diagnosis?





Pulmonary osteoma, osseous metaplasia, heterotopic bone

- benign condition of the canine lung
- the most common cause of mineralized pulmonary nodules
- Nodules caused by pulmonary osseous metaplasia

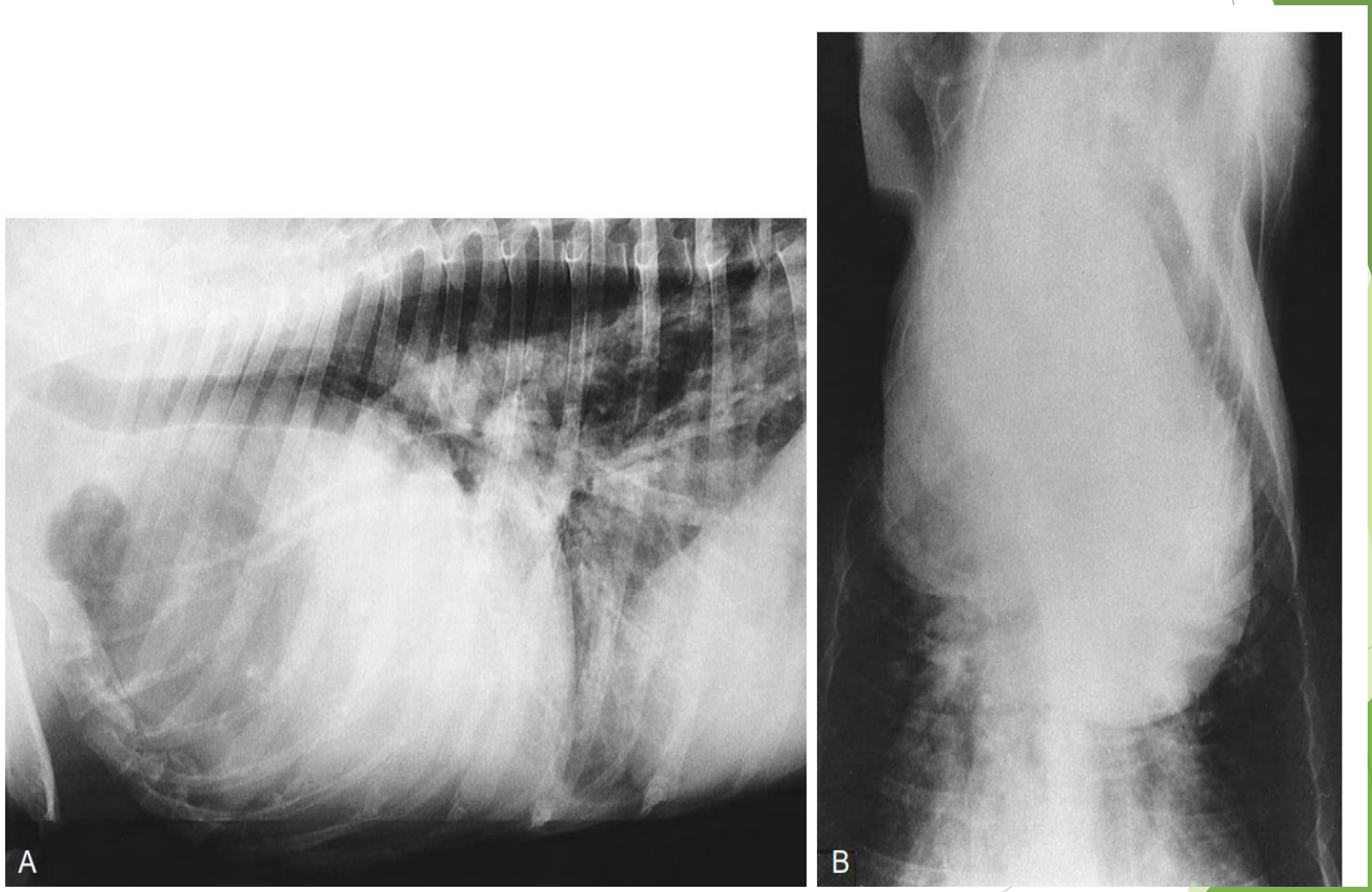
- The size of the pulmonary osteomas is less than 6mm but they are visible because they are mineralized

- Shouldn’t consider them as metastasis

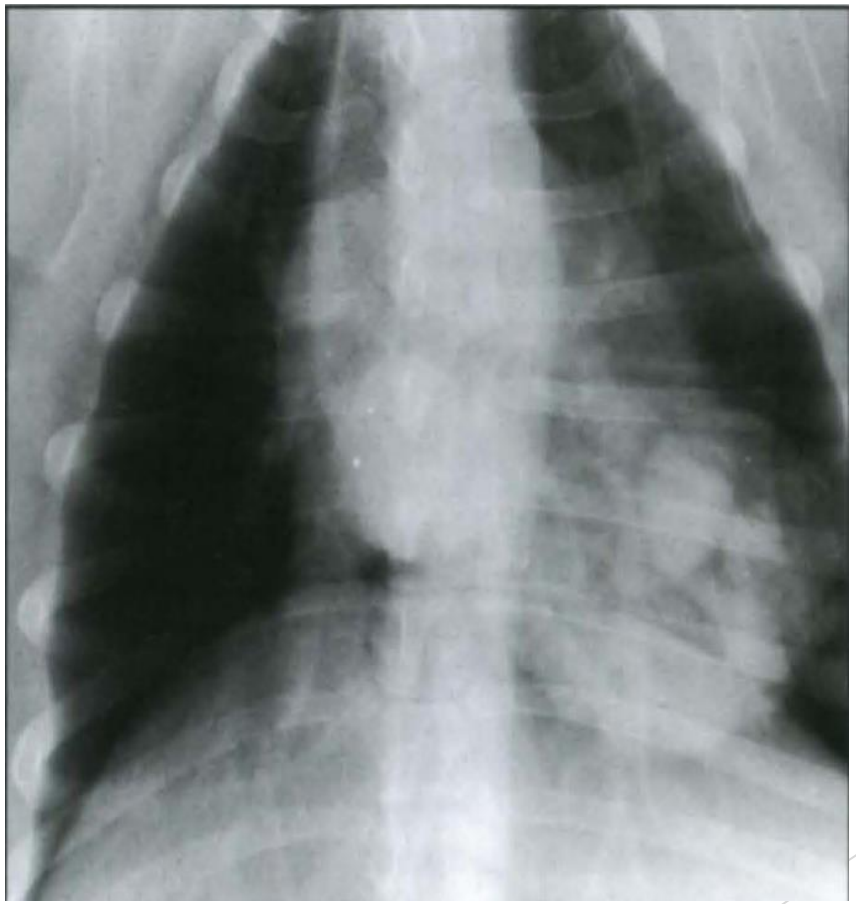
Primary lung tumours

- Different lung patterns could be seen with primary lung tumors
- primary lung tumors are mostly solitary and within a lobe / left lobes are more affected
- Cavitary or solid mass : structurized interstitial pattern
- Cavitary : in cats
- Bronchial pattern : diffuse tumor
- Alveolar pattern
- Histiocytic sarcoma : larger than other types of tumors/ mostly in left cranial and Rt middle lobe, air bronchogram
- Adenocarcinoma: left caudal lobe

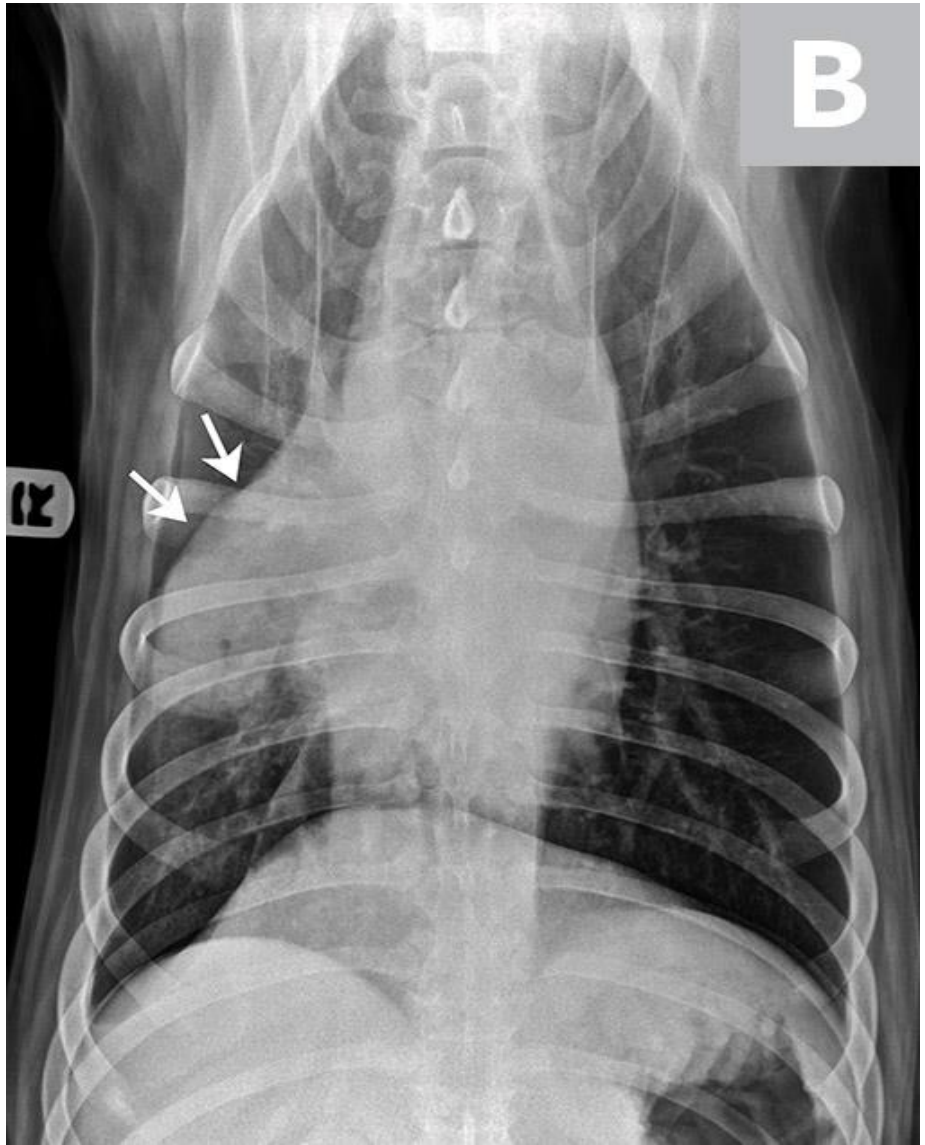
Primary bronchogenic carcinoma

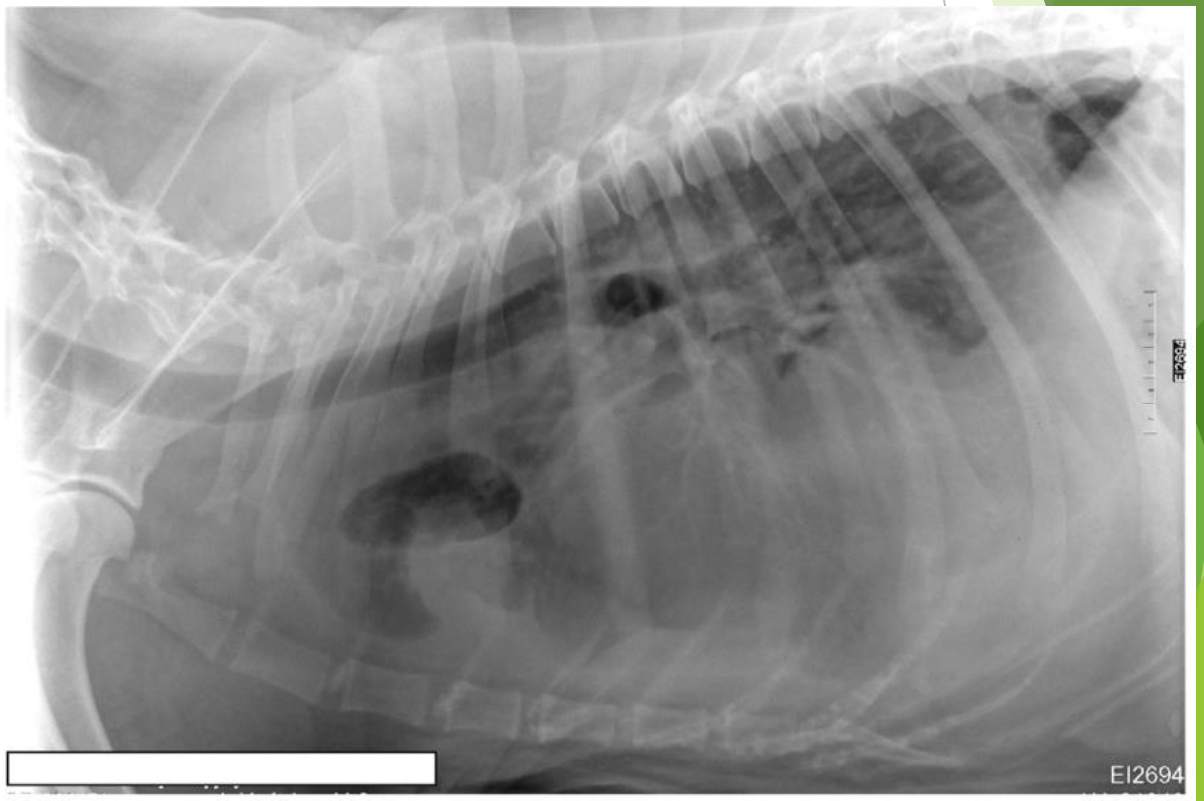


Pulmonary adenocarcinoma



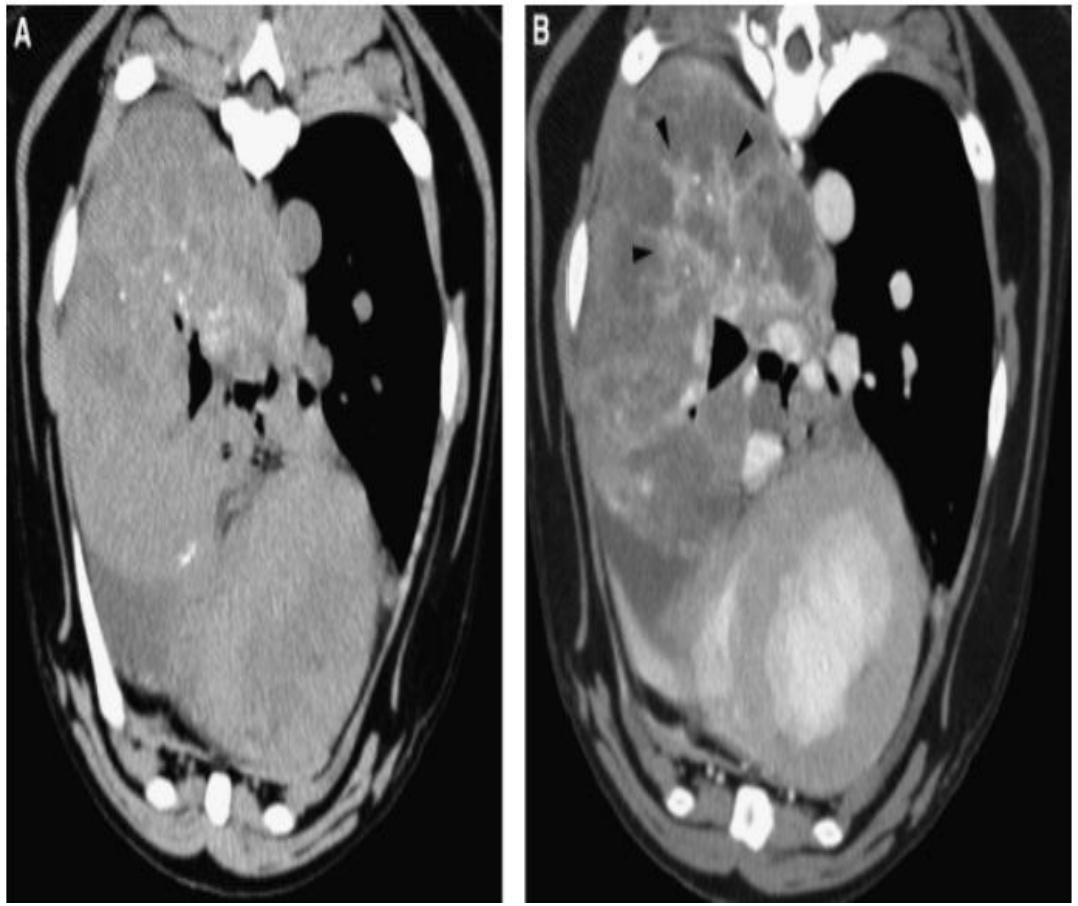
Histiocytic sarcoma in a dog





Computed tomography is more sensitive for lung tumors

- Location
- Blood supply
- Volume
- Lymphadenopathy



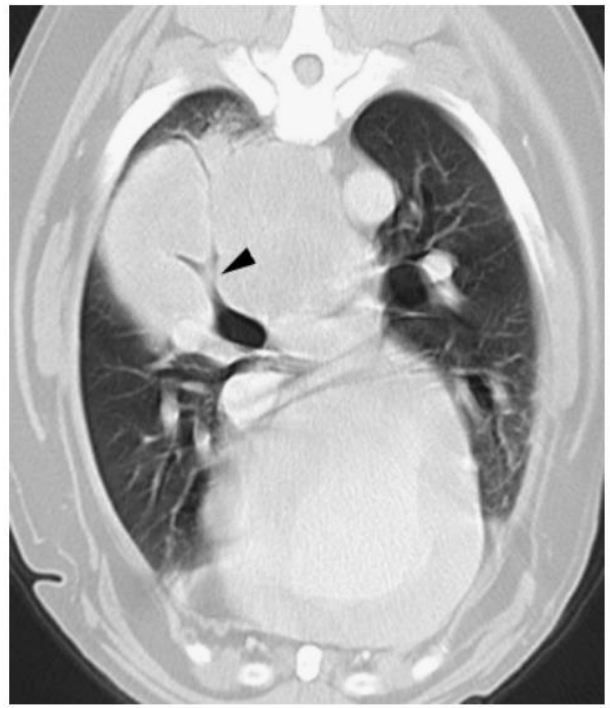


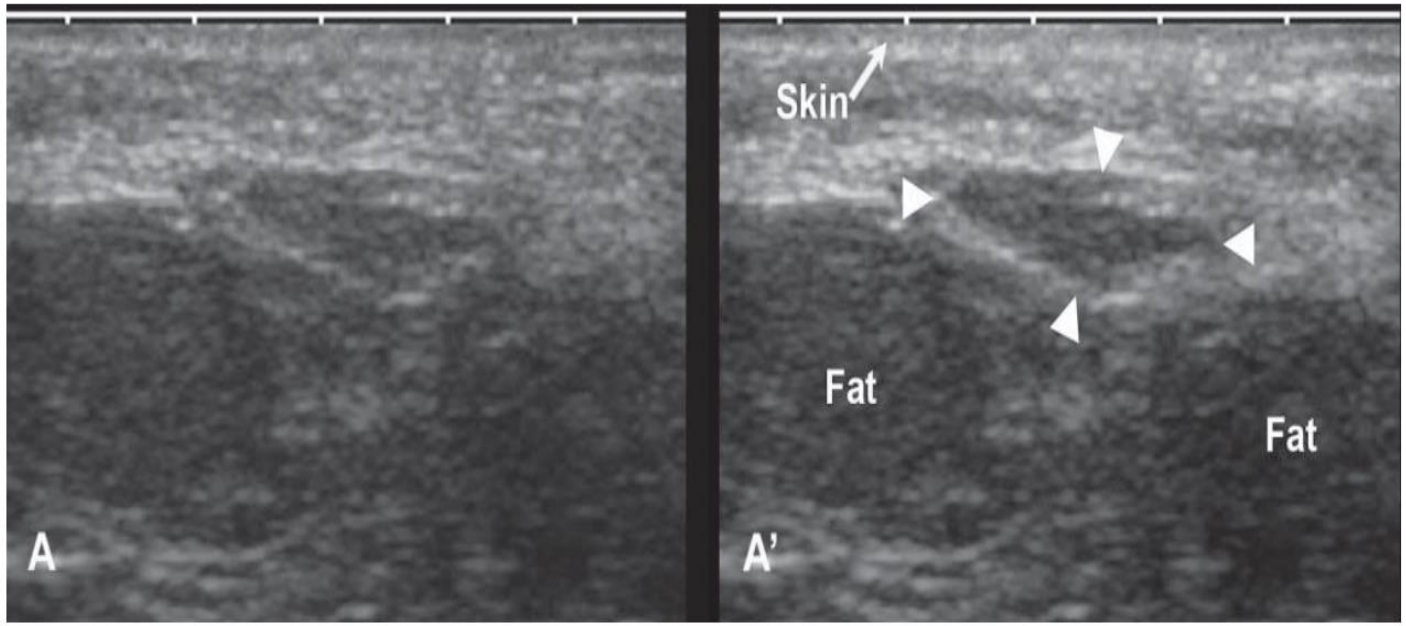
FIG. 1. Postcontrast image of a solitary lung tumor in the right caudal lobe. Note the solid consistency and well-defined margins. An air bronchogram is coursing through the middle of this mass (black arrowhead). WW = 1600, WL = −520.

Mammary Gland tumor

- Ultrasonography
- Mammary tumors appear ultrasonographically as irregular, mixed echogenic mass lesions of variable size
- Benign and malignant mammary tumors cannot be differentiated based on their appearance using conventional or color-flow Doppler ultrasound
- As metastases are common in malignant tumors, the axillary and/or inguinal lymph nodes should be examined for enlargement and abnormal echotexture.

- Radiography for metastasis

Normal mammary gland



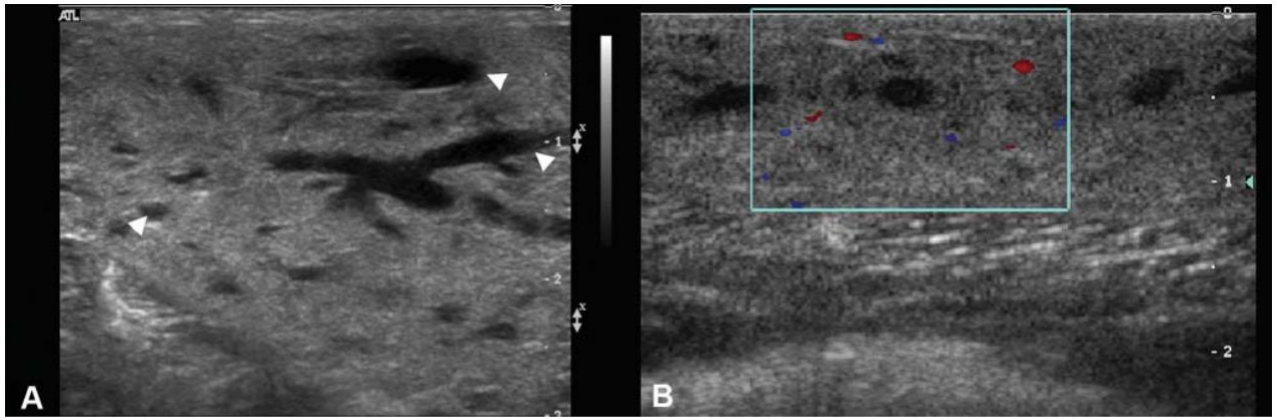


Figure 13.37. Active mammary tissue in a 4-year-old dog 2 days prior to parturition. A: The mammary tissue measures up to 3 cm in thickness, is of medium echogenicity, and contains numerous tubular milk-filled ducts (arrowheads). **B:** On color Doppler examination, there is no color signal detected in the ducts.

Complicated mammary carcinoma

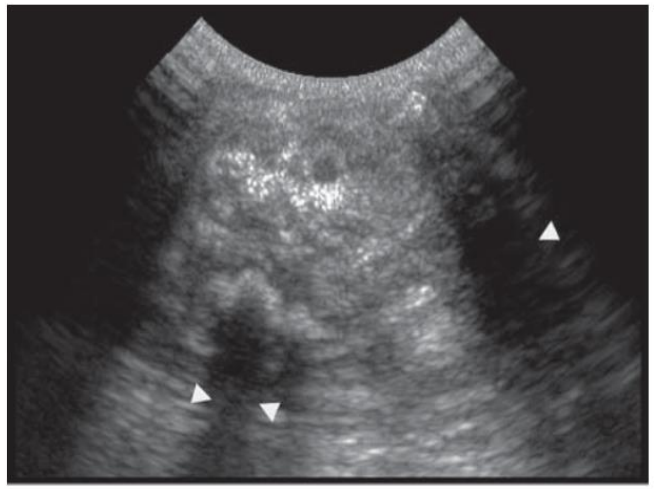
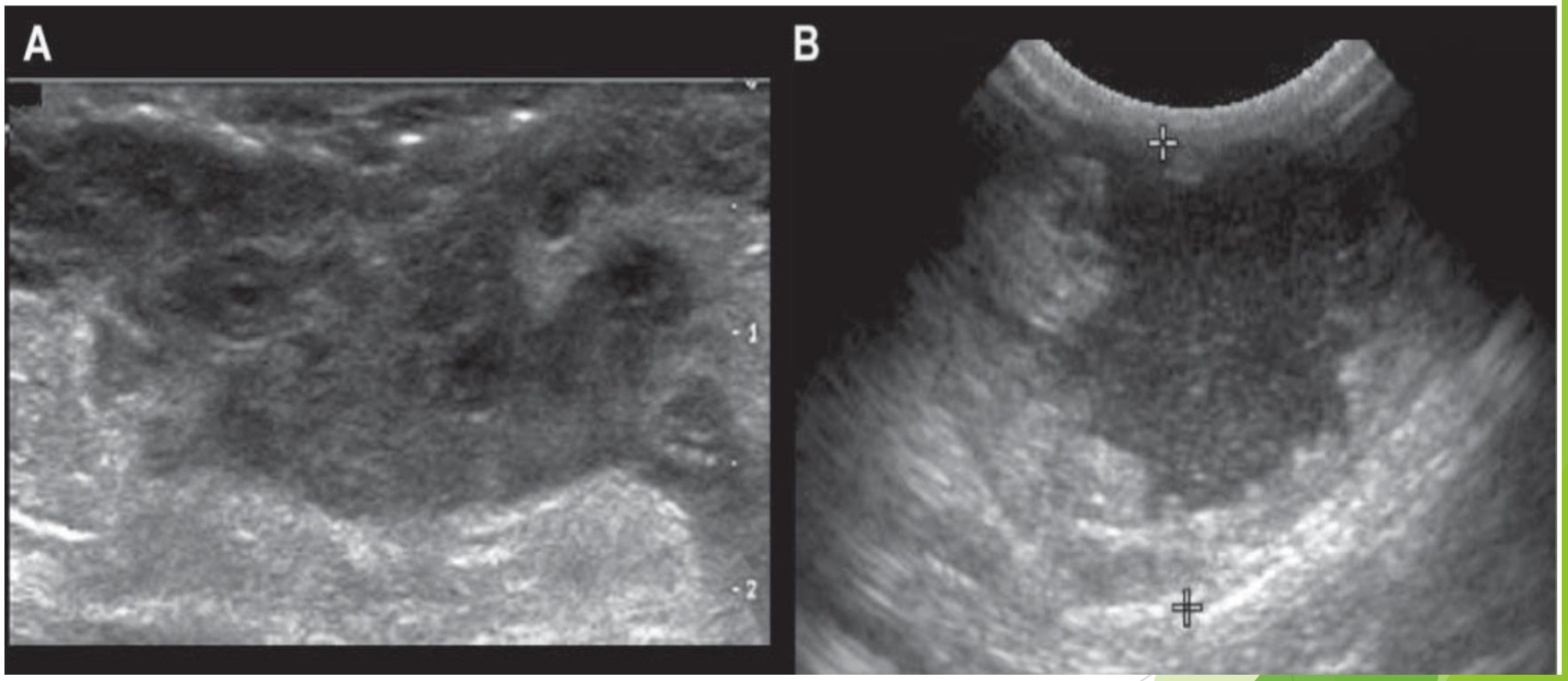
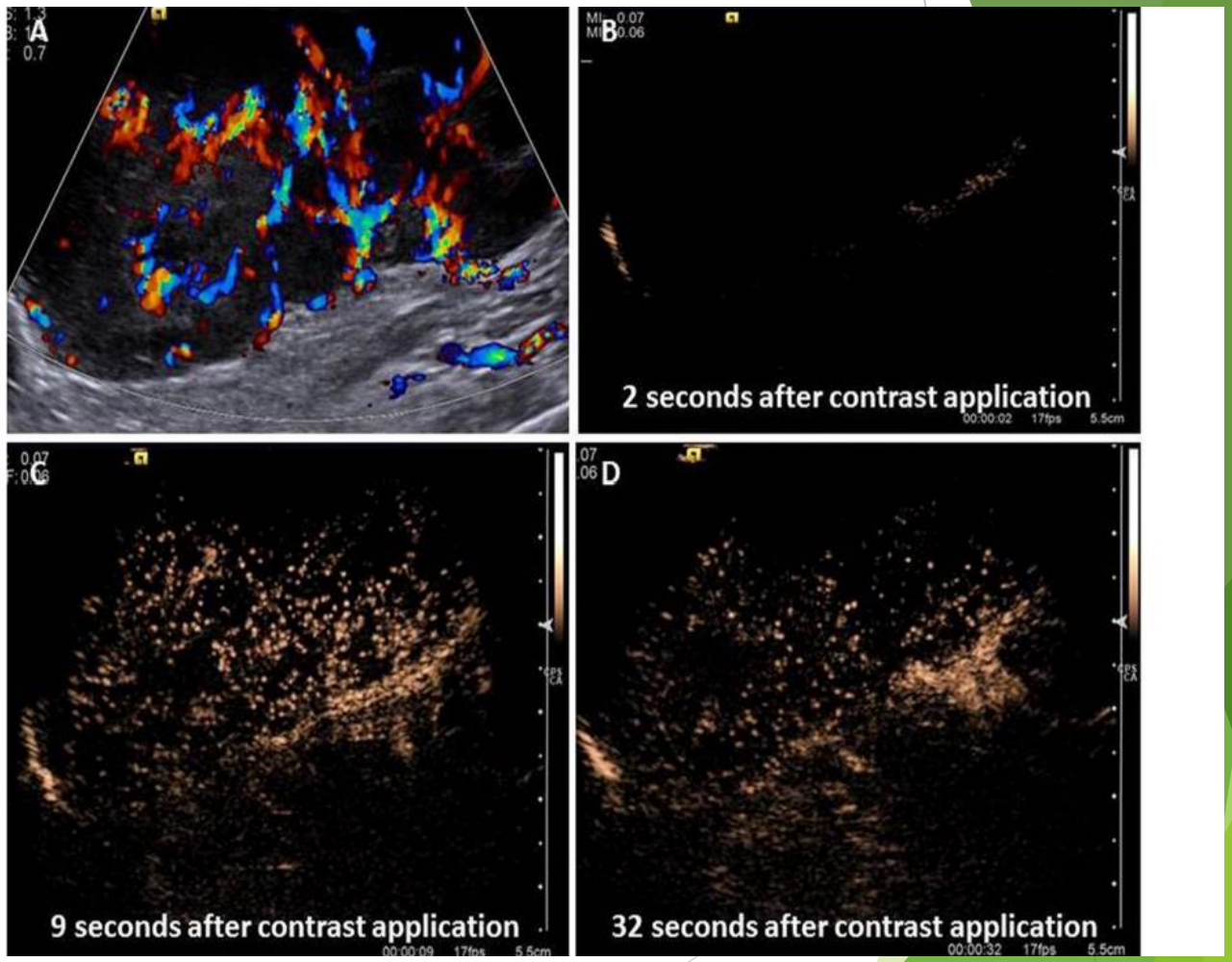


Figure 13.38. **Mixed mammary tumor in a 6-year-old Rottweiler.** An approximately 3-cm heterogeneous mass is associated with a mammary gland. Strong distal acoustic shadowing (arrowheads) indicates mineralization.



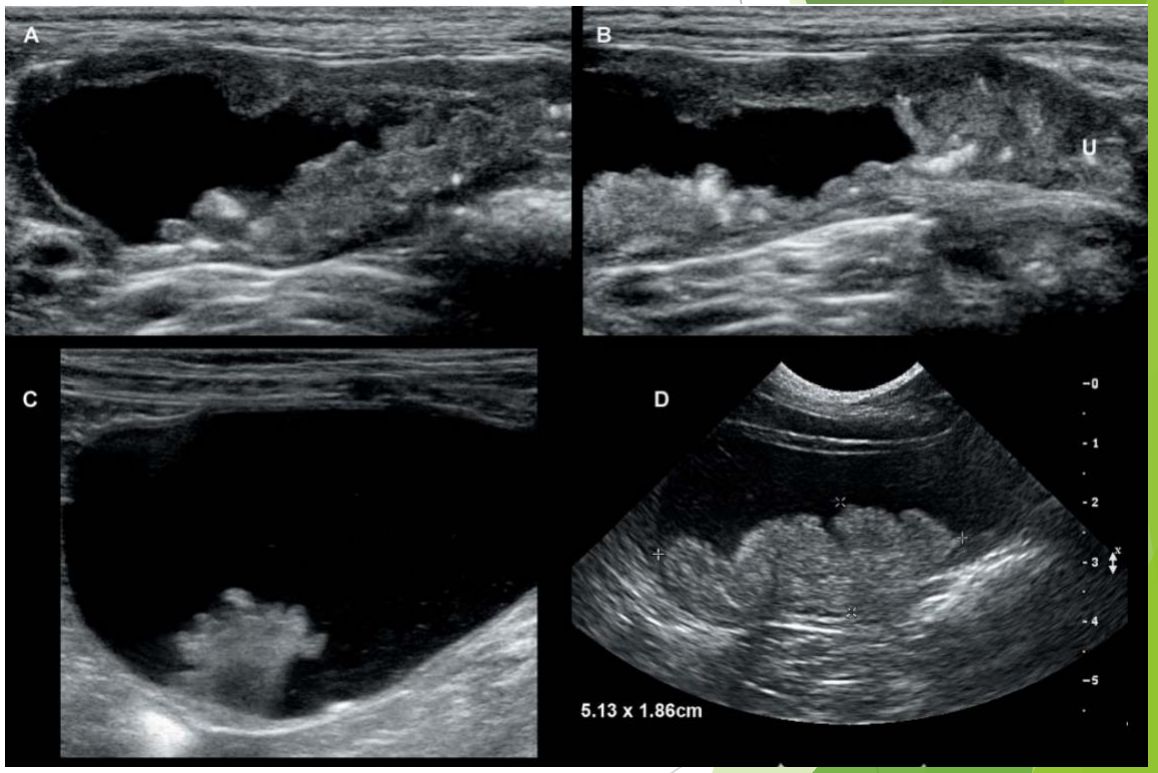
CFD and CEUS of a mammary gland carcinoma

- High blood supply



Urinary bladder: Transitional cell carcinoma

- Most common neoplasm of the UB wall
- Irregular mass with a broad-base attachment to the wall
- Mixed echogenicity
- Mostly in UB neck and dorsal wall



- Enlargement of regional lymph nodes: medial iliac, hypogastric, sacral, or superficial inguinal lymph nodes

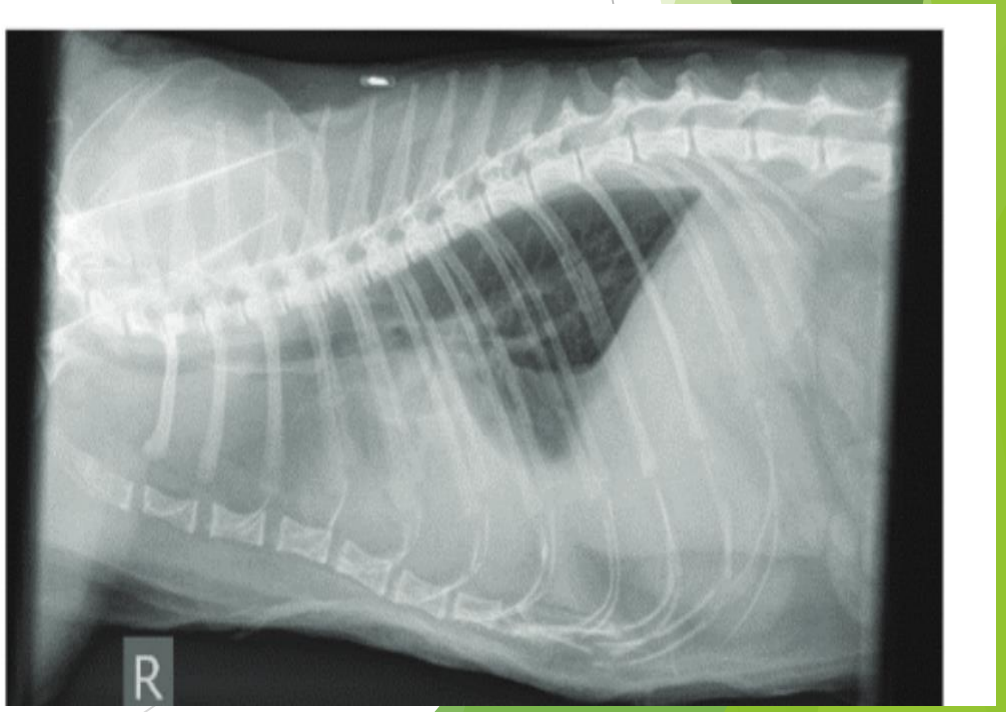
Lymphoma

- One of the common malignancies in veterinary medicine
- Although canine lymphoma can affect any dog breed, middle-sized to larger dog breeds are overrepresented/ multicenteric
- Common in cats/ 3 types: visceral (liver or spleen)/ extranodal (skin and CNS) and nodal
- Middle age to older

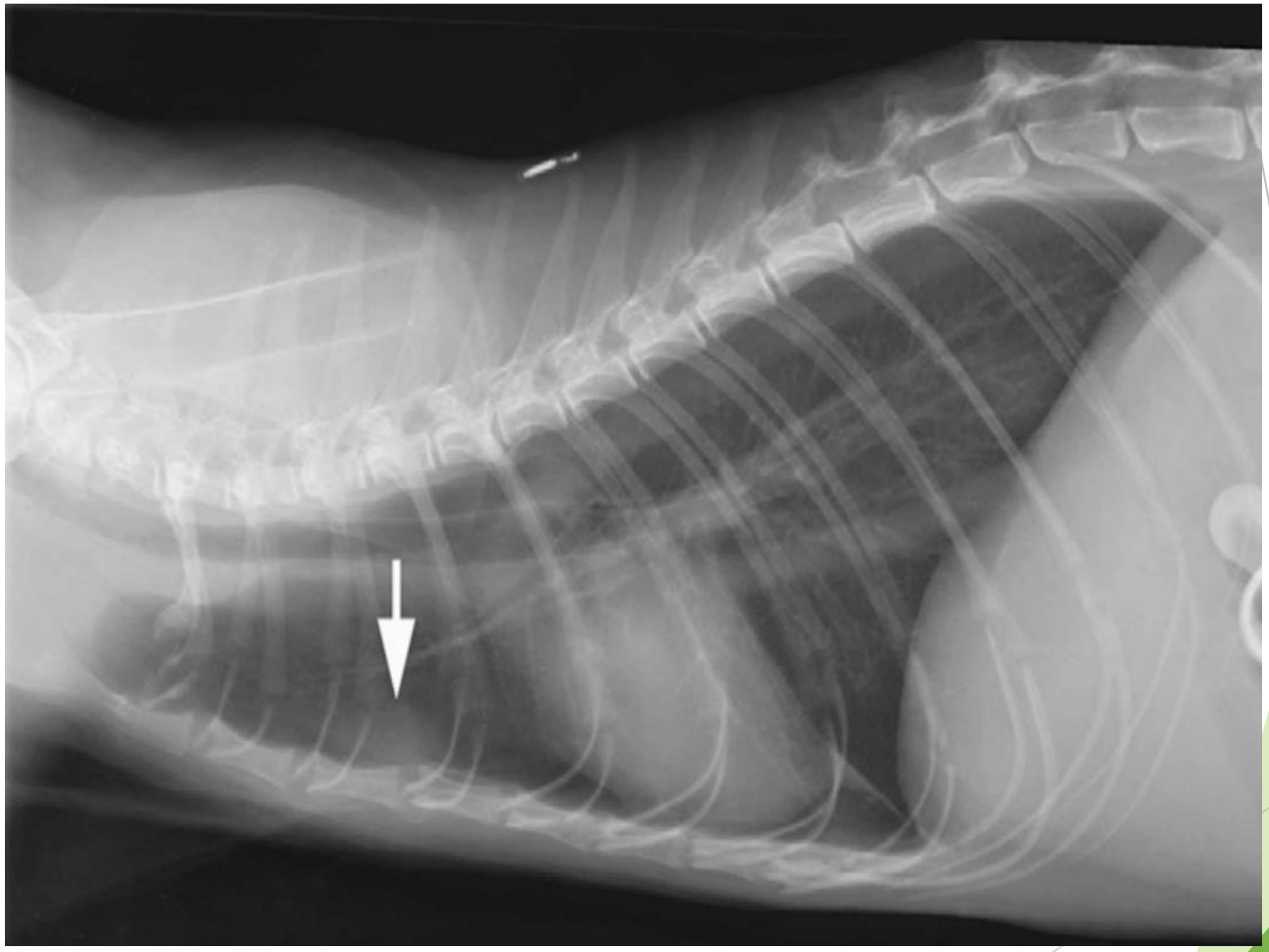
Mediastinal lymphoma

- In the cat, lymphoma is a common cause of enlargement of the cranial mediastinal lymph nodes. The thymus may also be affected.

- In the dog, lymphoma results in enlargement of the sternal lymph nodes in slightly more than half of affected patients, but enlargement of cranial mediastinal or tracheobronchial lymph nodes is uncommon



Sternal lymph node lymphoma



Gastrointestinal lymphoma

- In dogs and cats, the most common ultrasonographic findings in GI lymphoma are transmural thickening associated with the diffuse loss of normal wall layering, reduced wall echogenicity, decreased localized motility, and regional lymphadenopathy
- Jejunal lymphadenopathy is a common finding in intestinal lymphoma and in some instances can be responsible for most of the mid-abdominal mass effect
- Occasionally, the omentum and mesentery may be diffusely infiltrated, and be responsible for the large mass effect, detected on palpation, or seen radiographically
- Ulcerated lymphoma can be encountered as an irregular mucosal surface or as a large defect centered on the affected portion of the GI tract
- GI lymphoma can display several lesions along the GI tract, and they uncommonly create partial or complete obstruction

Normal GI wall in ultrasonography

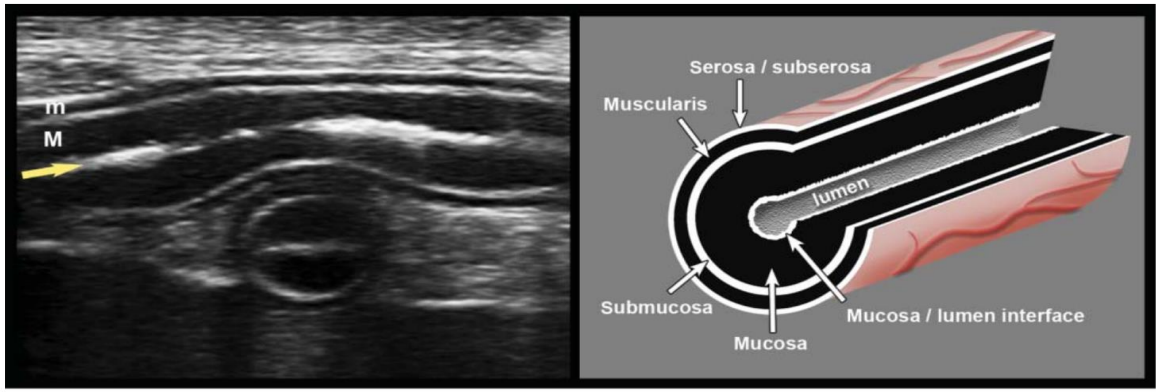
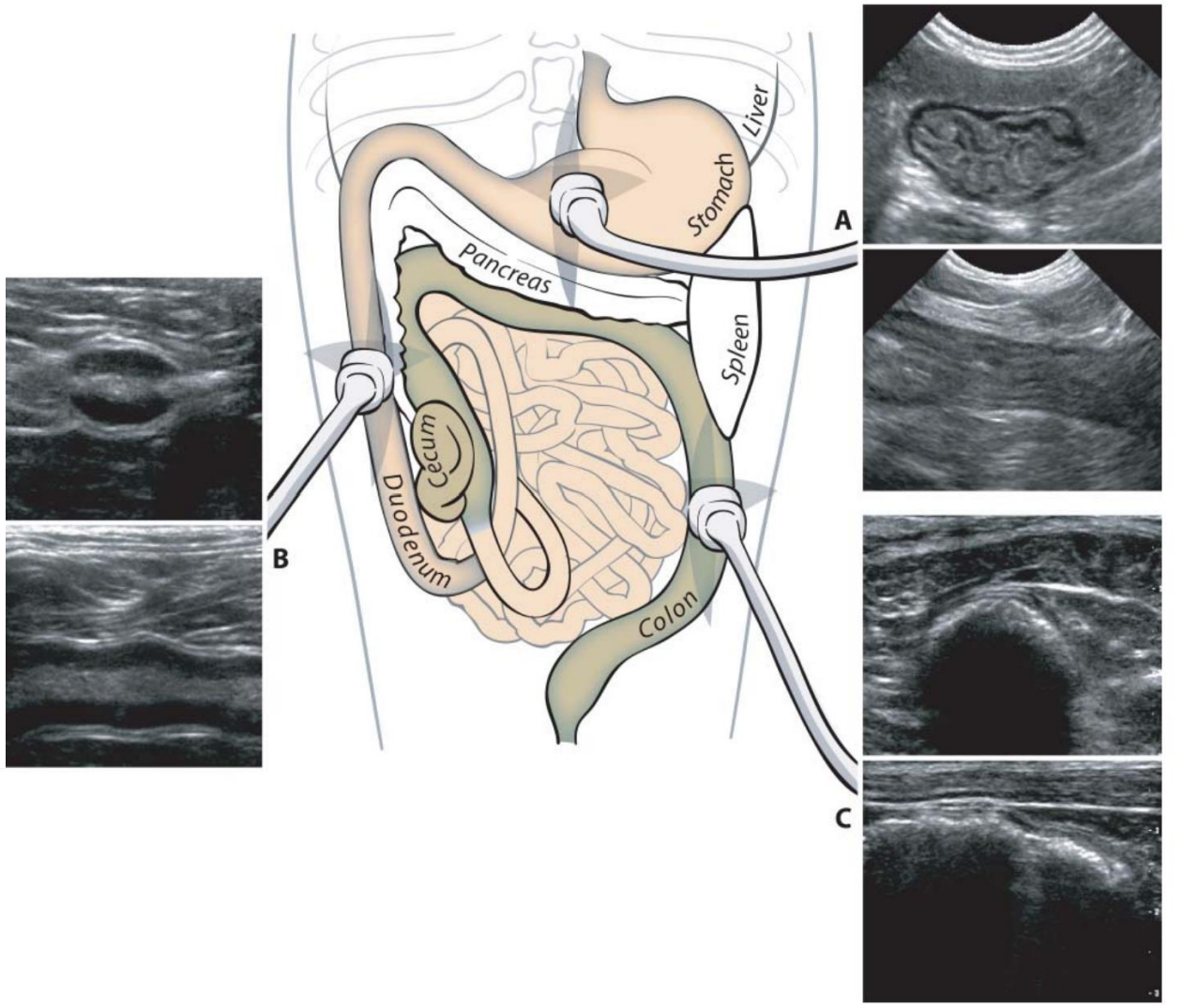


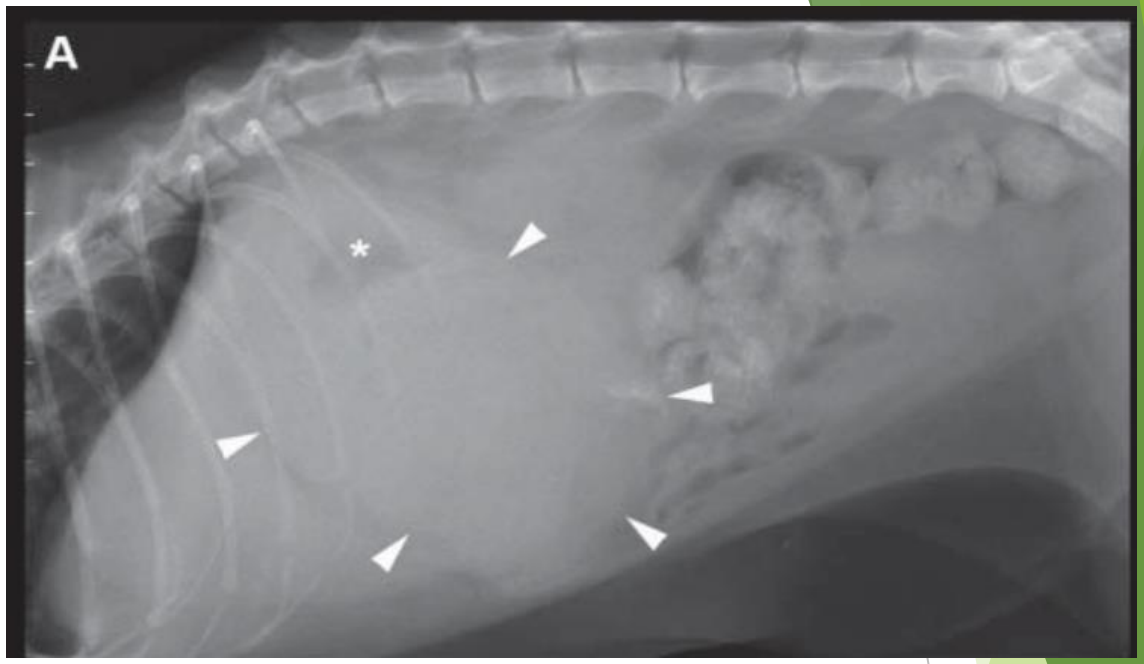
Figure 8.5. **Normal intestinal layers.** Sonogram of two intestinal segments, one sagittal in the near field and the other in the tranversal plane. The yellow arrow points to the lumen. Part of the spleen is seen in the far field. M, mucosa. M, muscular layer. On the right, the five ultrasonographic layers are illustrated. The lumen varies in echogenicity according to its content. It is bordered by a hyperechoic interface that delineates the thick, nearly anechoic mucosal layer. Then the thin hyperechoic submucosa, thin nearly anechoic muscularis, and thin hyperechoic subserosa/serosa can be visualized.

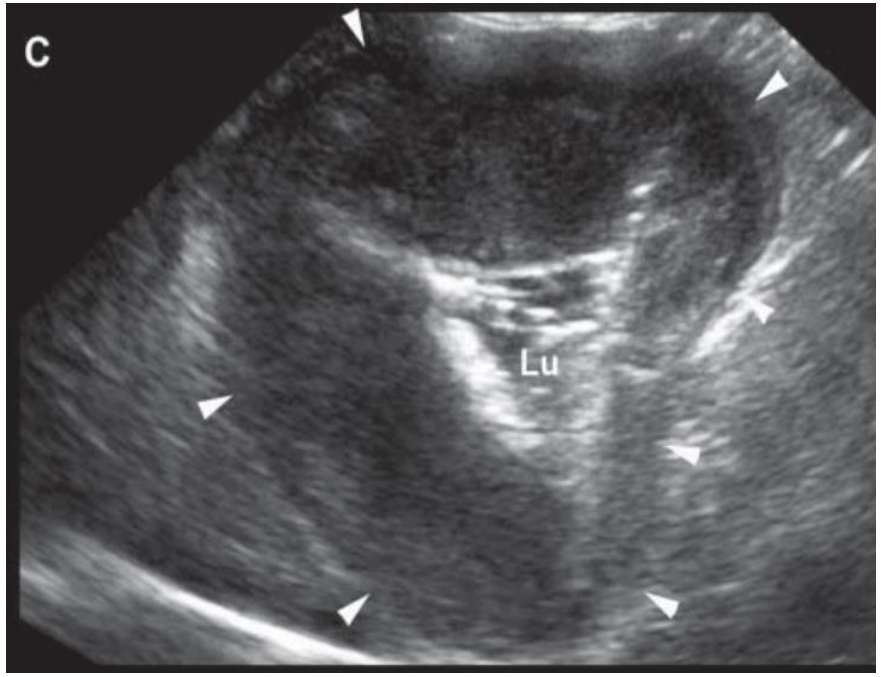


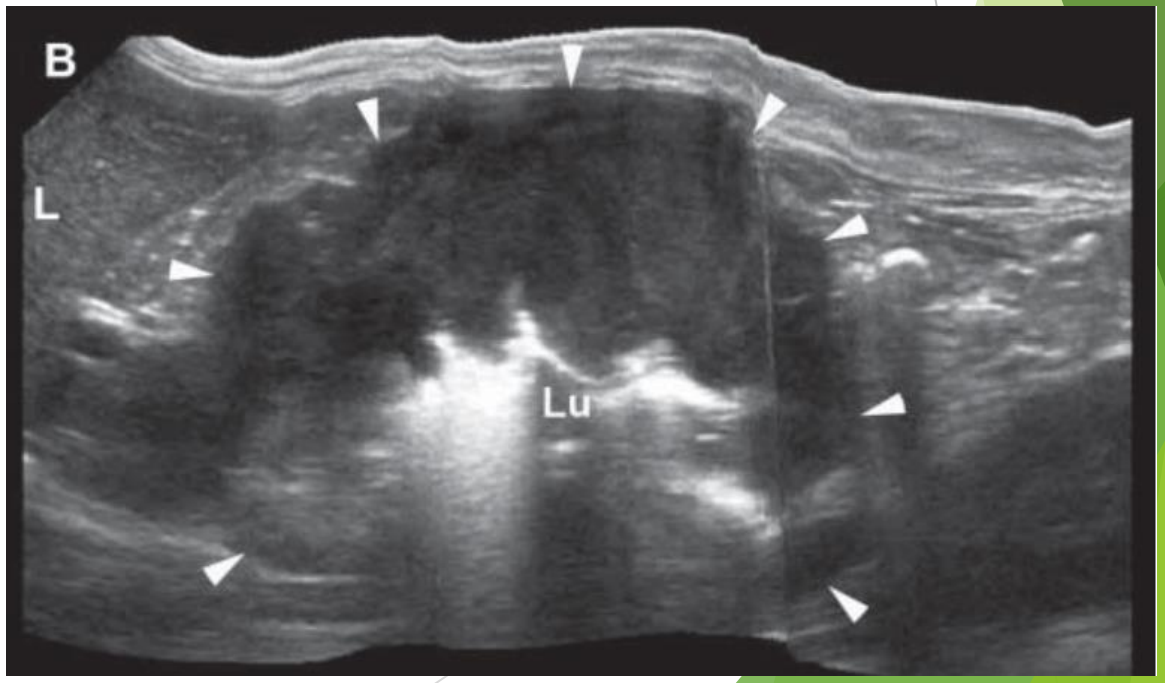
Gastric Lymphoma

- Transmural circumferential infiltration of

Lymphoma in gastric wall in a cat



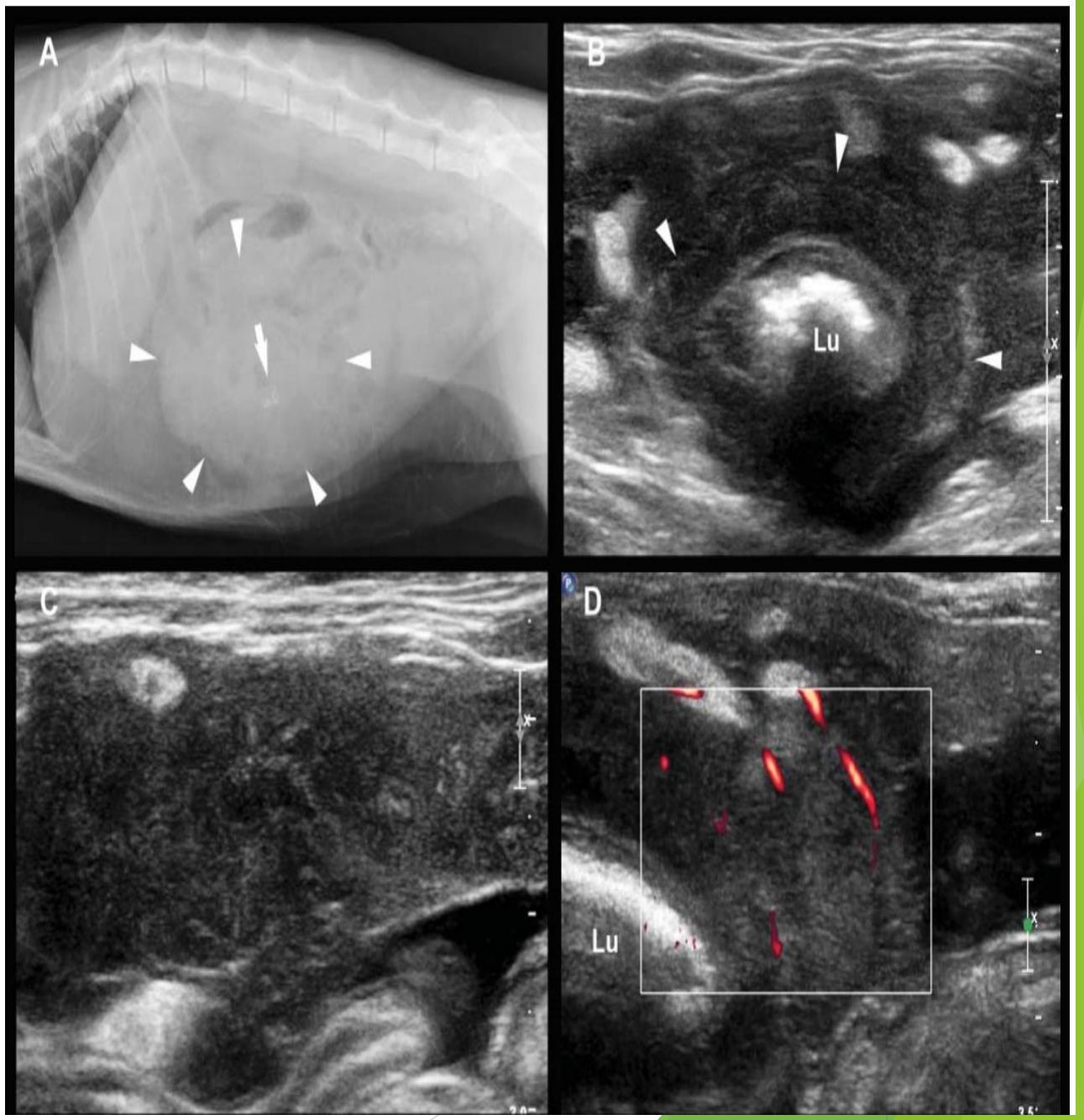




Jejunal lymphoma

- 2-year-old cat with mid abdominal mass

- Poorly differentiated wall thickening in Jejunum along with high blood supply



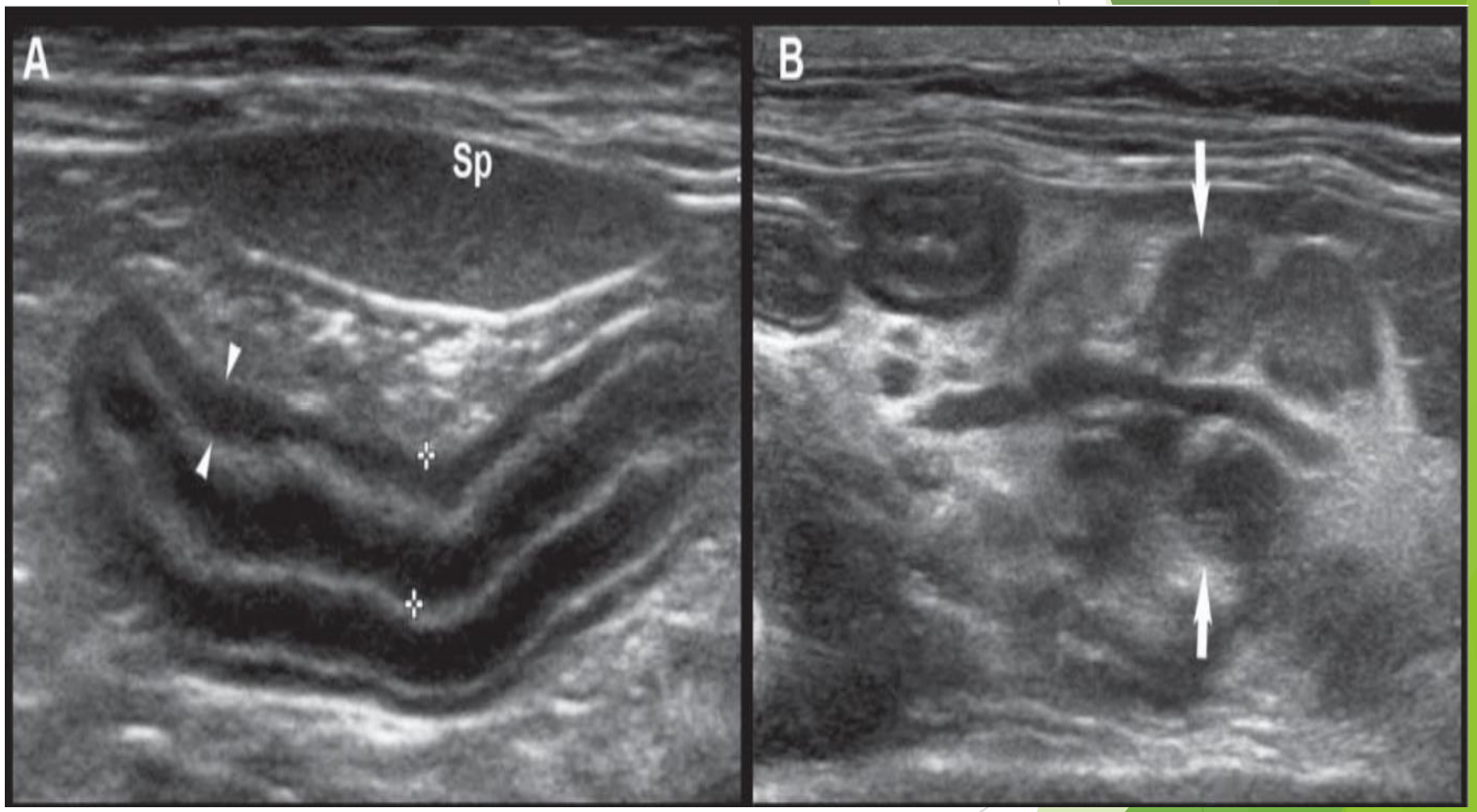
Challenging Lymphoma!

- No change of the wall layering

- Only thickening of the wall and

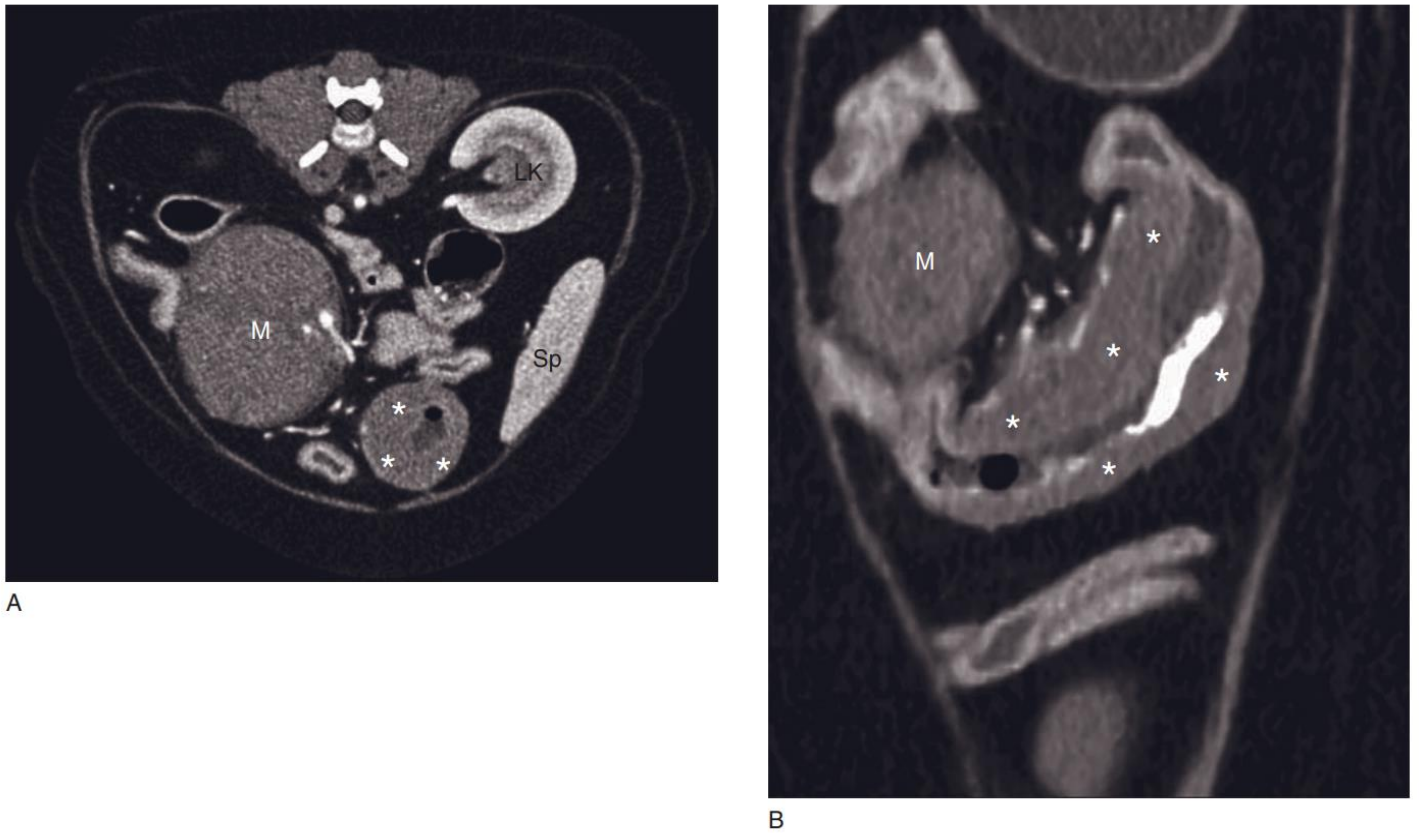
Lymphadenopathy and steatitis

- Biopsy



GI lymphoma in CT scan

- Thickening
- Contrast enhancement



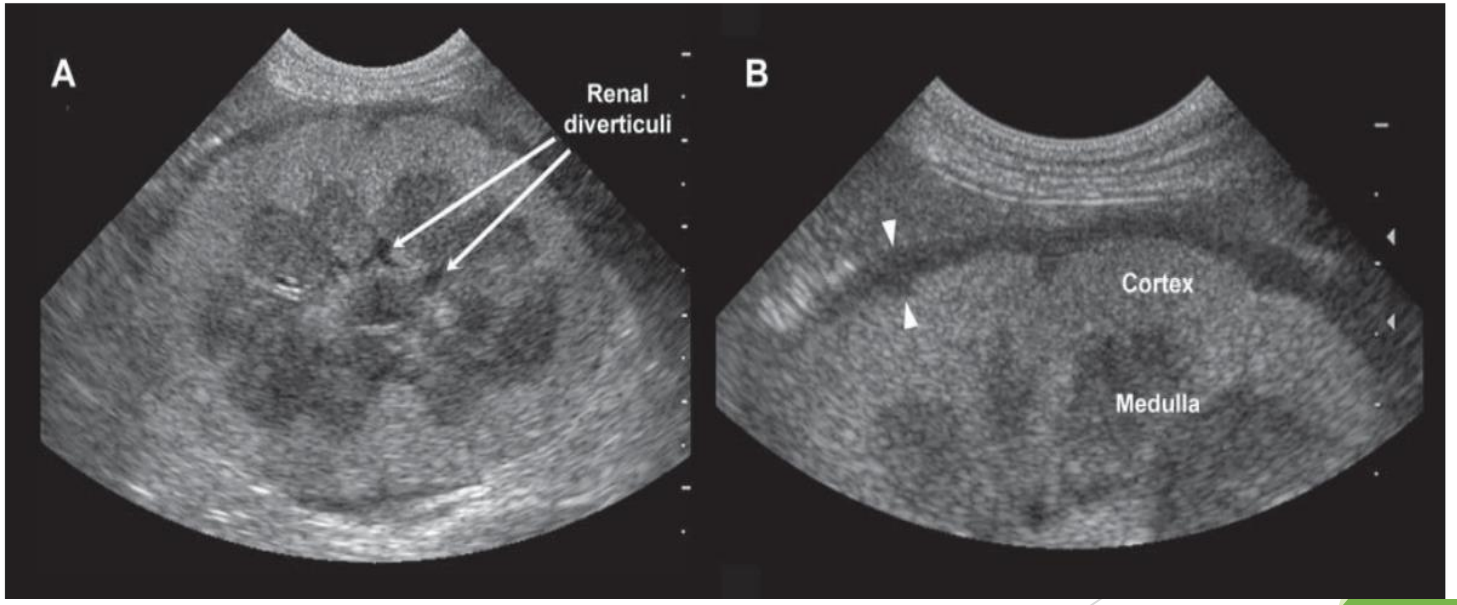
A B

Figure 31.7 Adult cat with intestinal lymphoma. (A) Post-contrast transverse CT image shows a transverse slice of the small intestine filled with mucus and gas with a severely thickened and asymmetric wall (asterisks). A large circular mass (M), diagnosed as a tumoral lymph node after biopsy, is visible in the right abdomen displacing the small intestines. (B) Post-contrast dorsally reconstructed CT image shows an asymmetric thickening of the small intestinal wall over a few centimeters (asterisks). The intestinal lumen is filled with mucus, a small gas bubble and a trace of contrast medium. The previously described lymph node is visible (M). LK = left kidney; SP = spleen.

Renal lymphoma

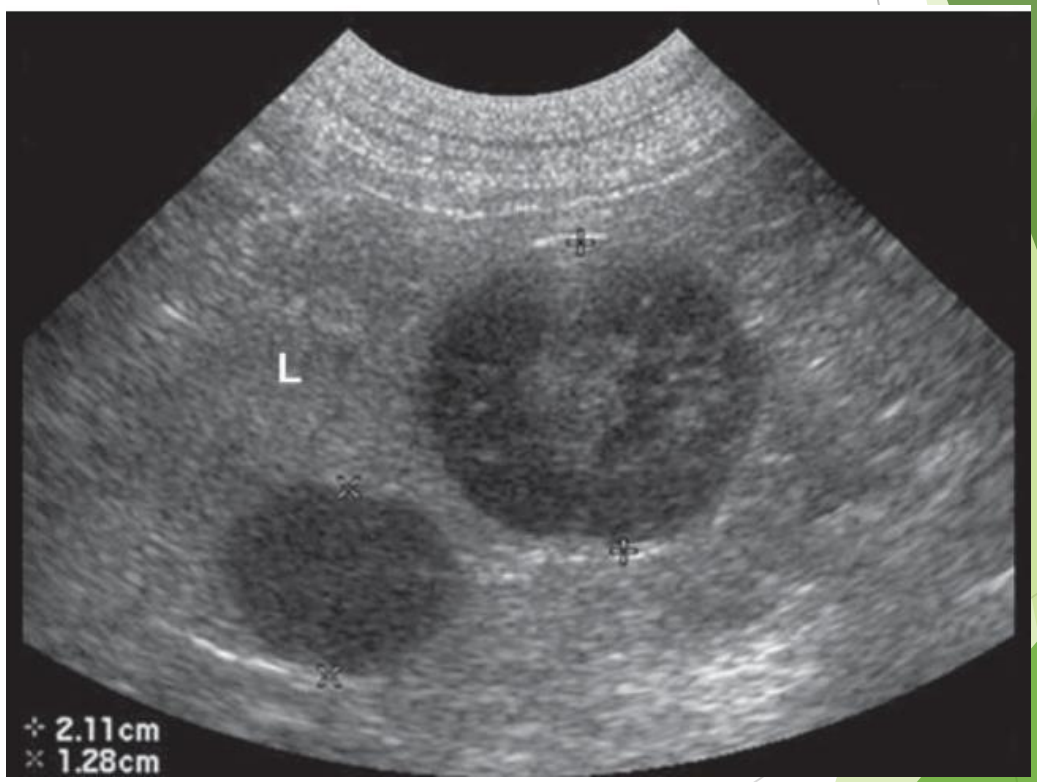
- Neoplastic processes typically cause focal or multifocal renal changes, with the exception of lymphoma in cats

- With lymphoma in cats, the kidneys typically become enlarged, irregular, and hyperechoic and often present characteristic hypoechoic subcapsular thickening



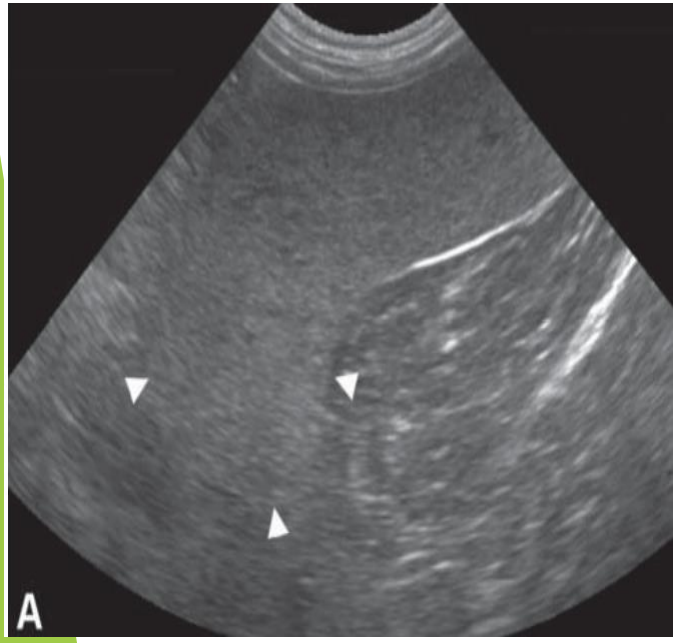
Hepatic Lymphoma

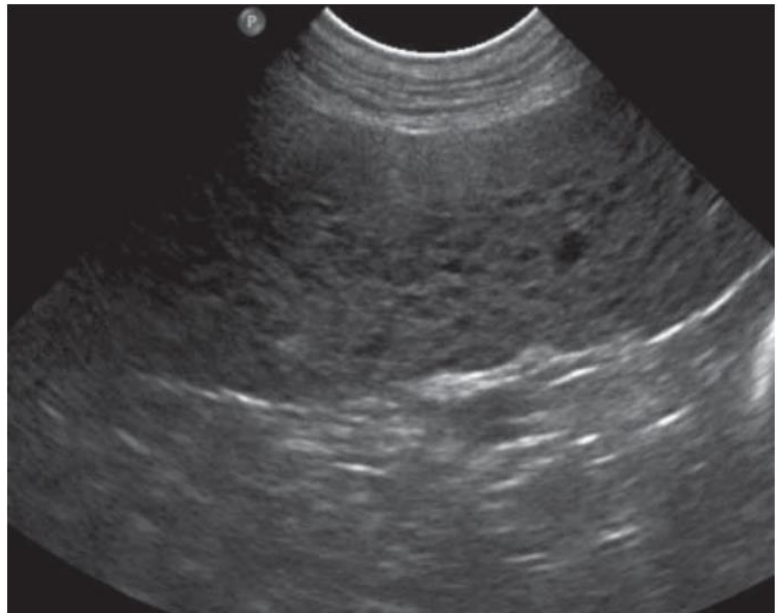
- Round cell tumors in liver can have variable appearances from normal to abnormal changes like mass like lesion



Splenic lymphoma

- Different appearances and changes
- Splenomegaly to non-specific parenchymal changes





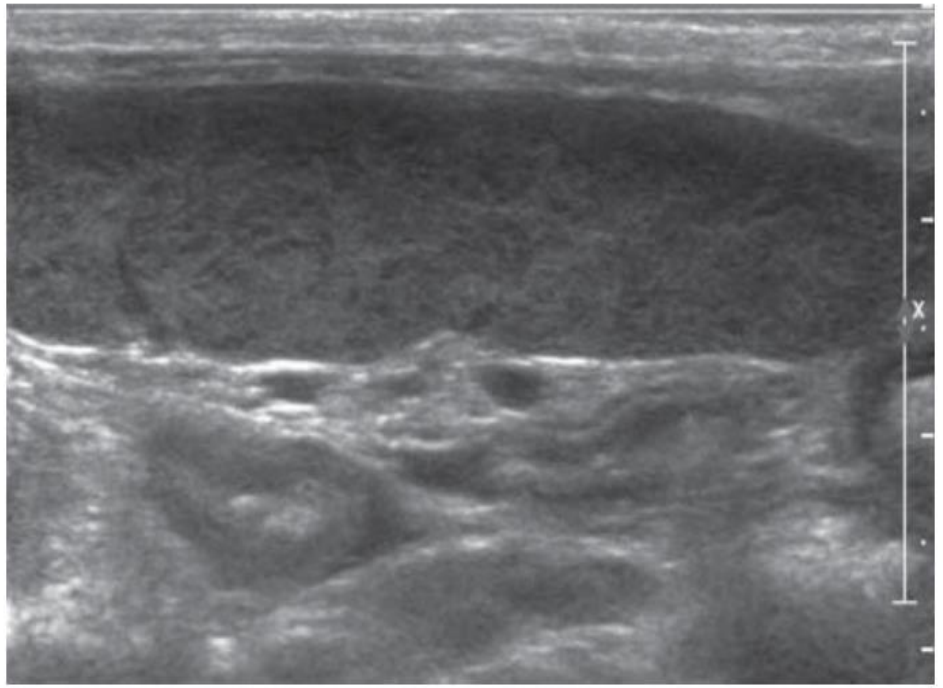


Figure 7.8. Lymphoma in a 12-year-old domestic shorthair cat. The spleen is enlarged (more than 1 cm in thickness) and has an inhomogeneous echotexture. A fine-needle aspirate confirmed the diagnosis of lymphoma.

CNS Lymphoma

- Lymphoma is the second most common intracranial neoplasm in cats, accounting for 14% of cases

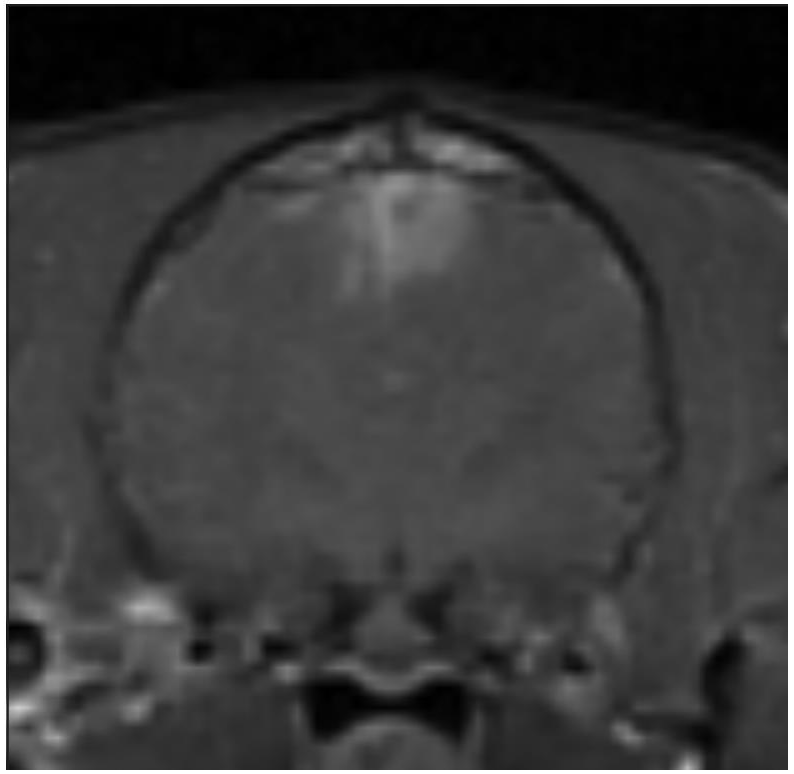


Fig. 5.4.20 Intracranial lymphoma in a 14-year-old DSH cat. The transverse post-contrast T1W image shows a poorly marginated contrast-enhancing mass lesion associated with the dorsal rostral aspect of the parietal lobes with concurrent meningeal enhancement along the falx cerebri. (1.5T MRI system; image courtesy of Dr. Matthew Baron, MedVet Cincinnati)

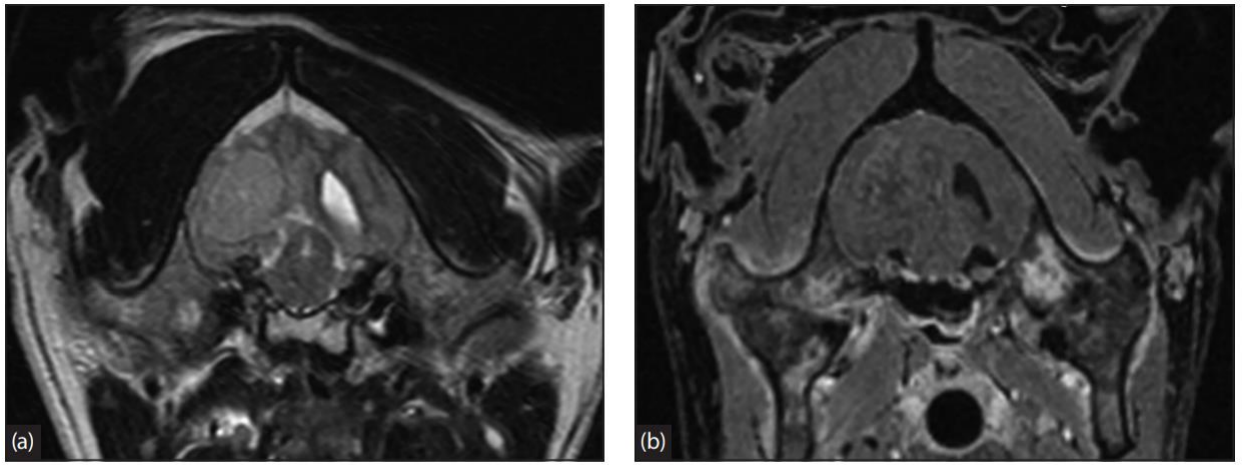


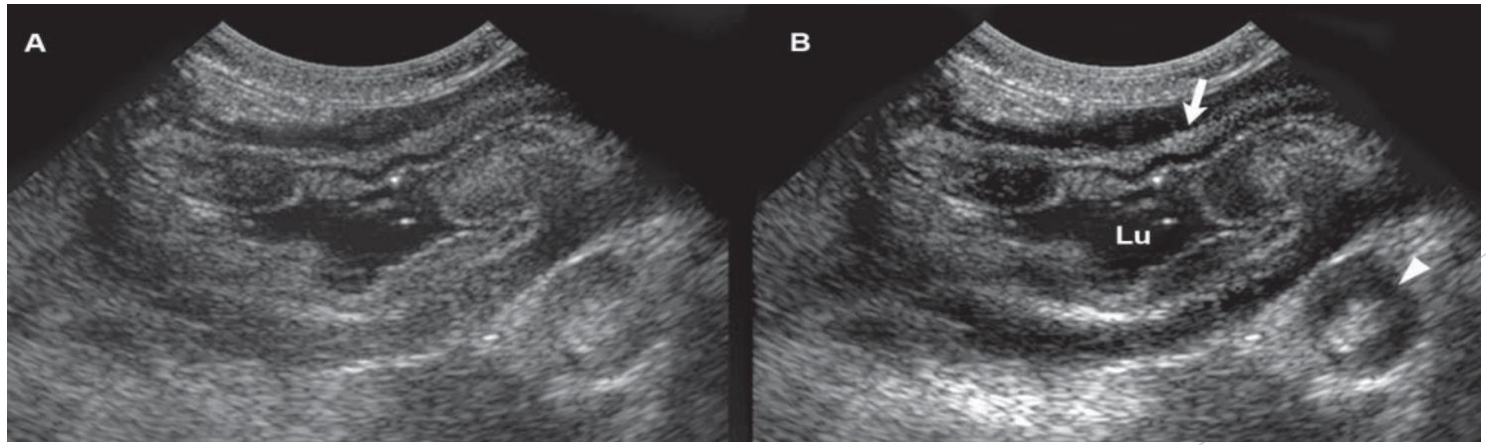
Fig. 5.4.21 Disseminated lymphoma in a 5-year-old Mastiff. The transverse T2W image (a) and post-contrast T1W gradient recalled echo image with fat suppression (b) show a large heterogeneous T2 hyperintense and mildly contrast-enhancing intra-axial mass associated with the right occipital lobe, with associated mass effect. Multifocal contrast enhancement of the masticatory musculature and the bones of the skull (most severely the temporal bones and mandible) is also noted. (1.5T MRI system)

CNS lymphoma (MRI)

- Poorly or well-defined
- Single or multifocal
- Intra-axial or extra-axial mass
- Variable intensity but typically isointense to hypointense on T1W images and isointense to hyperintense on T2W images, with moderate to strong contrast enhancement
- Meningeal involvement

Gastric wall carcinoma

- More common in dogs
- transmural thickening associated with altered wall layering that correlates with the unevenly layered tumor distribution noted histopathologically.
- This altered layering, previously called pseudo-layering, appears as a moderately echogenic zone surrounded by outer and inner, poorly echogenic lines
- In the majority of these cases, fluid/gas accumulation proximal to the focal intestinal thickening indicates a mechanical ileus.
- Same US features as lymphoma with some differences: shorter involvement in carcinoma/ mechanical ileus



Gastric wall carcinoma in CT scan

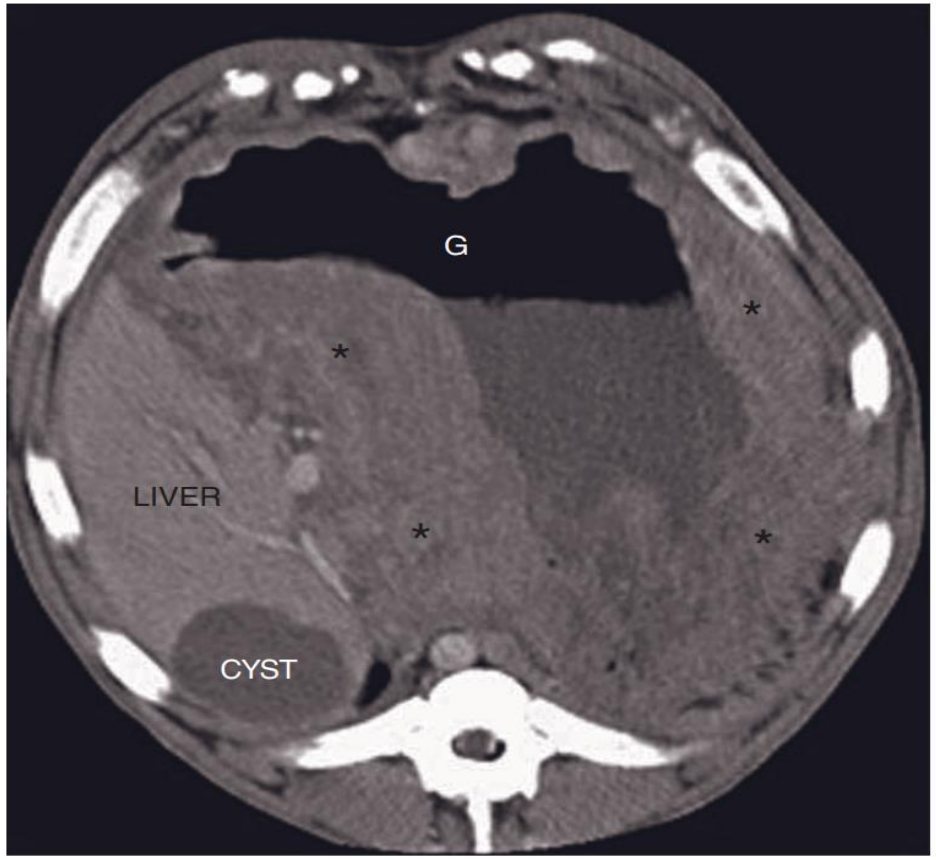


Figure 31.6 Adult dog with gastric adenocarcinoma. Transverse CT image (dog in dorsal decubitus) shows a soft tissue density mass involving almost the complete stomach wall (asterisks). The stomach is moderately filled with fluid and also contains gas (G). A cyst is present in the liver.

Meningioma

- Meningiomas are the most common brain tumors in dogs and cats, accounting for 45%–51.5% and 73% of reported cases, respectively
- They originate from the meningeal lining of the brain
- Golden Retrievers, Boxers, and Domestic Short-haired cats are predisposed

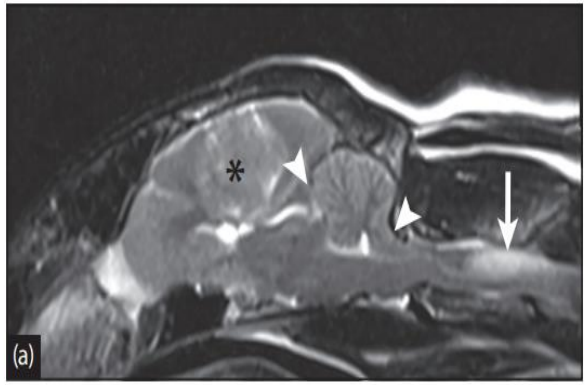


Fig. 5.4.1 Meningioma (meningothelial subtype) in a 9-year-old DSH cat. (a) Sagittal T2W image demonstrating a large mildly hyperintense lesion associated with the forebrain (asterisk), with associated mass effect. There is subtentorial and foramen magnum herniation (arrowheads) and cervical syringomyelia is noted (arrow). (b) Transverse T2W image demonstrating a large well-circumscribed mildly hyperintense mass with a strongly hyperintense rim in the periphery of the left frontal, parietal, and temporal lobes, which is in broad-based contact with the overlying skull. There is a significant mass effect with associated midline shift and compression of the ventricular system. (c) On the transverse T1W image, the mass is isointense to mildly hypointense. Thickening of the overlying cortical bone (hyperostosis) is evident (arrows).

Meningioma

- Round/ovoid or plaque-like usually smoothly marginated mass associated with the brain, typically in broad-based contact with underlying bone
- Usually single lesion, but presence of multiple tumors possible
- Typically hypointense to isointense on T1W images, hyperintense on T2W/T2-FLAIR images, and strongly contrast-enhancing (homogeneous, heterogeneous, or ring enhancement possible)

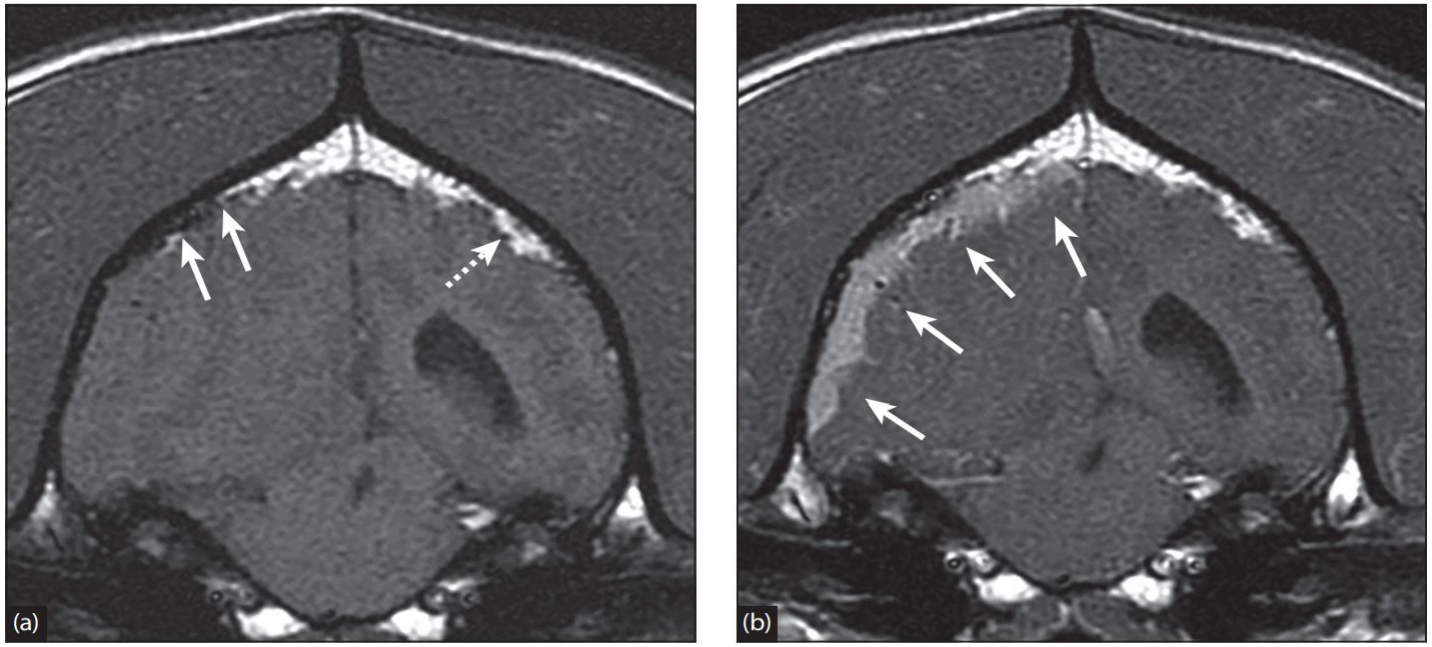


Fig. 5.4.3 Transverse T1W pre- (a) and post-contrast (b) images in a 12-year-old Golden Retriever with an 'en-plaque' meningioma along the right temporal lobe. There is sclerosis/hyperostosis of the calvarial bone (solid arrows, a) with the hyperintense bone marrow being replaced by hypointense bone sclerosis; compare with the normal bone marrow on the contralateral side (dashed arrow, a). On the post-contrast image (b), there is marked plaque-like meningeal thickening and enhancement (arrows, b). (1.5T MRI system; images courtesy of Dr. Wilfried Mai, University of Pennsylvania)

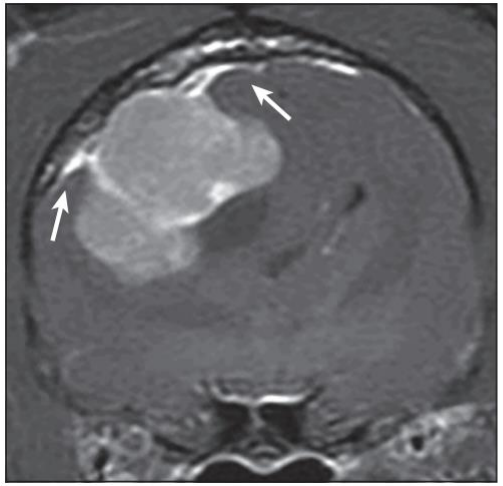


Fig. 5.4.4 Transverse T1W post-contrast image of the brain in a 12-year-old DSH cat with a large meningioma. Strong contrast enhancement of the mass is noted and there is tapering meningeal enhancement/thickening on the margins of the mass (arrows) consistent with a 'dural tail'. This sign is commonly seen with meningiomas, although it is not specific for that type of tumor. (1.5T MRI system; image courtesy of Dr. Wilfried Mai, University of Pennsylvania)

Splenic hemangiosarcoma

- Variable shapes

- Mass like lesion which can be solid or

Cavitary with mixed echogenicity and high

Blood supply

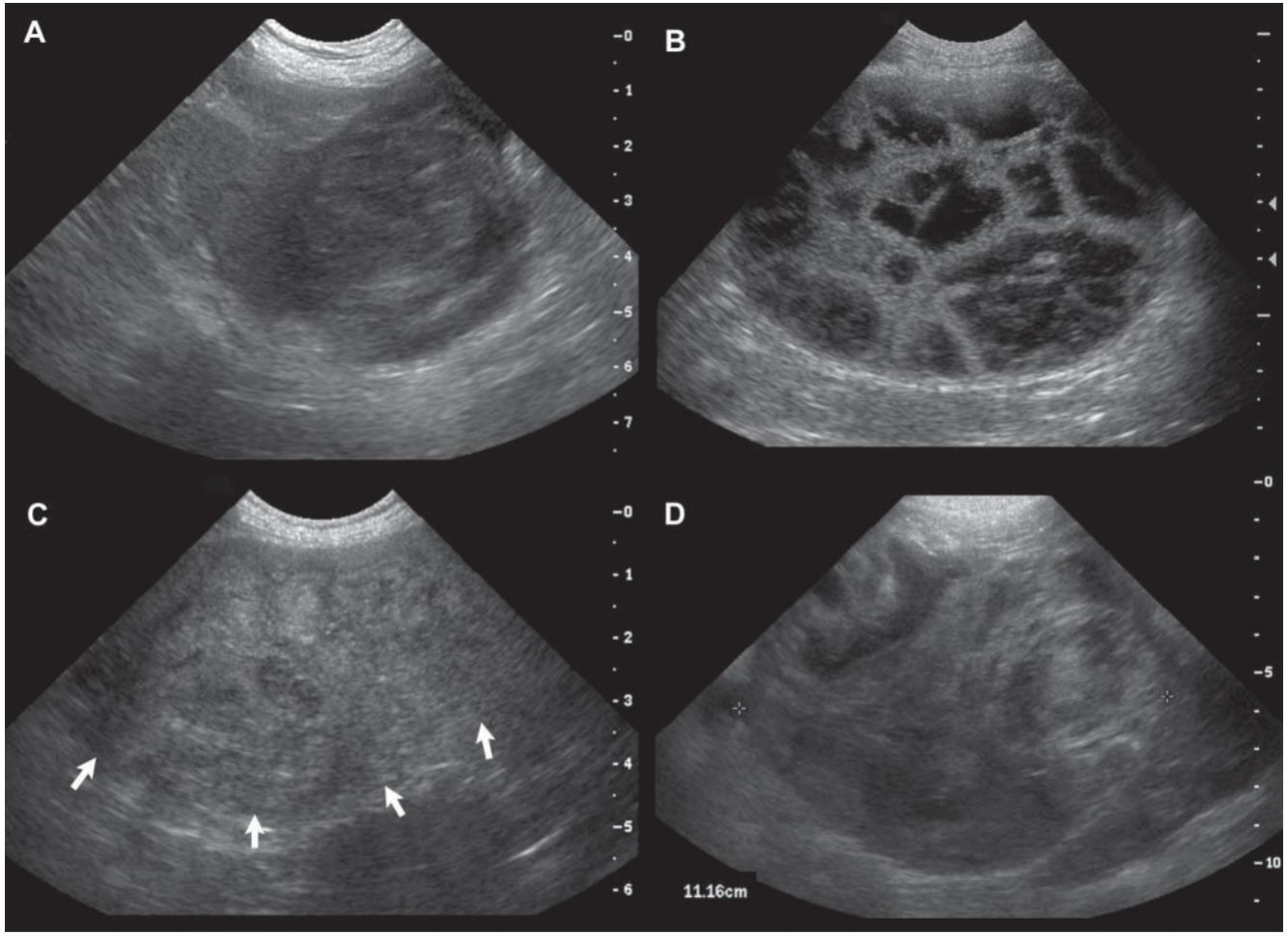
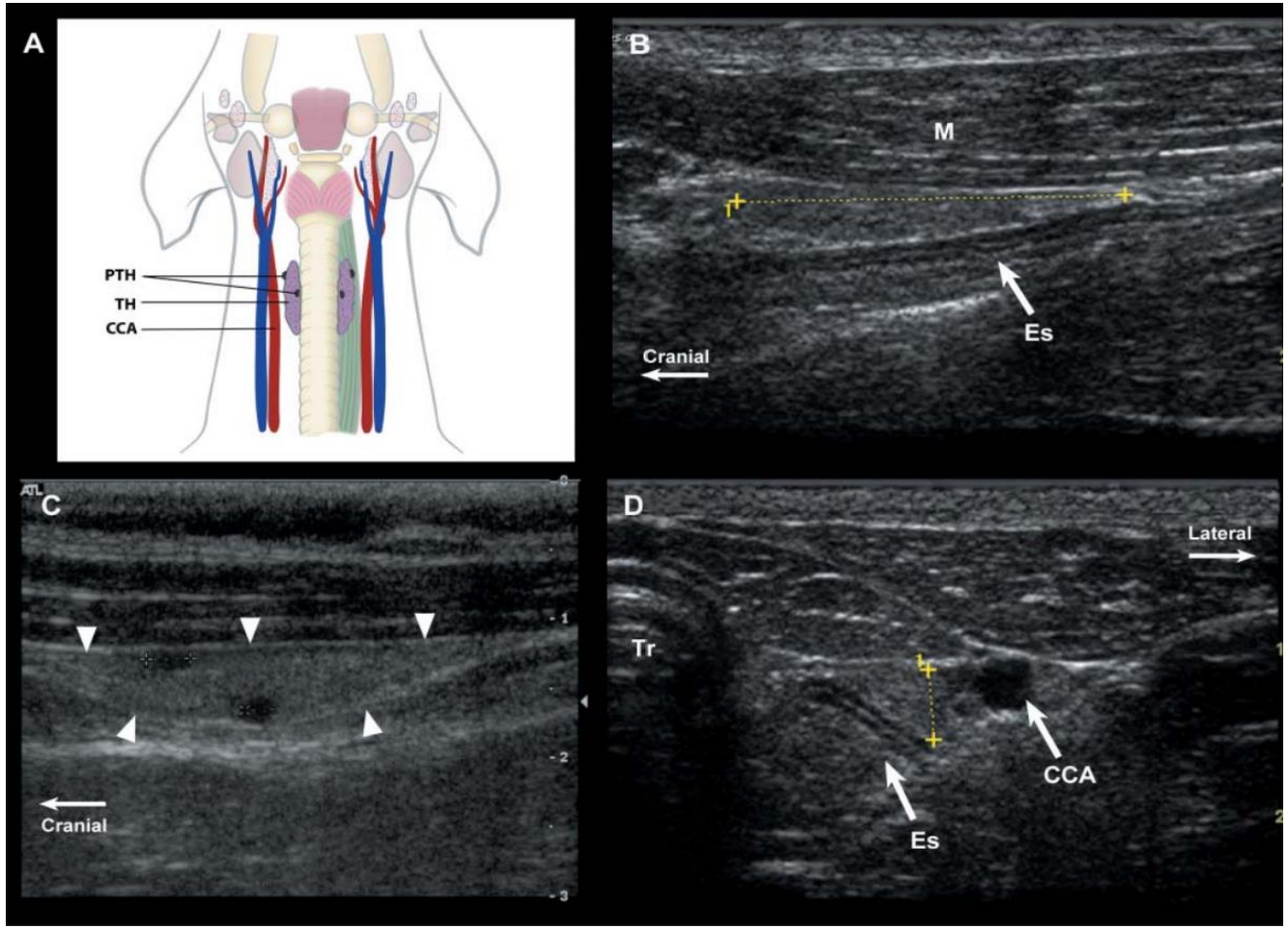
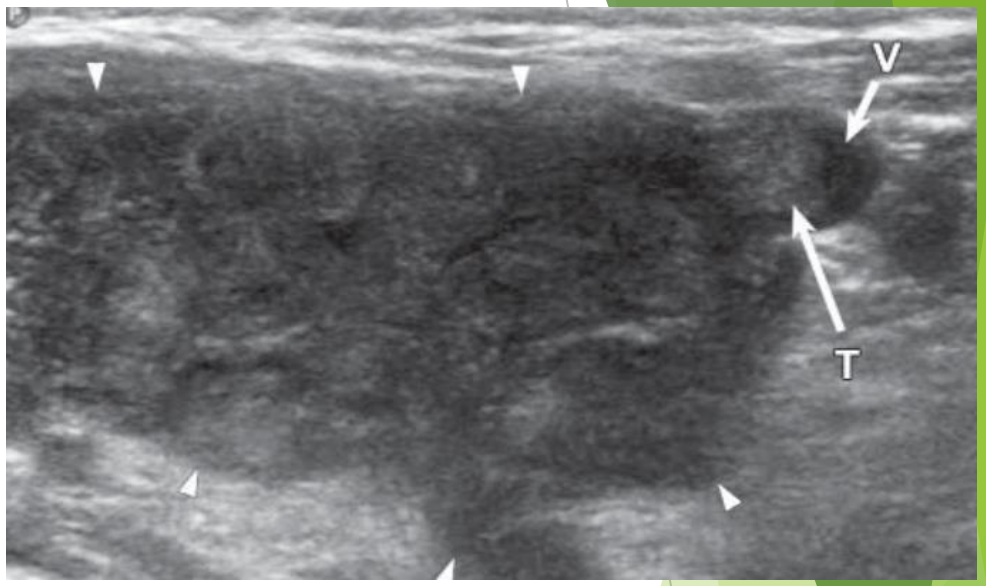


Figure 7.32. **Variable appearances of splenic hemangiosarcoma in dogs. A:** Approximately 6-cm-diameter, mixed echogenic and mainly hypoechoic mass in a 12-year-old Border Collie. **B:** A round, well-circumscribed, mixed echogenic and cavitated mass of 8 cm diameter in a 4-year-old Golden Retriever. **C:** Ill-defined, mixed echogenic mass (arrows) associated with the spleen of a 9-year-old Golden Retriever, replacing most of the normal parenchyma. **D:** Mixed echogenic mass of more than 11 cm diameter associated with the spleen (between the cursors) in an 8-year-old German Shepherd Dog.

Thyroid carcinoma






Thanks for your attention
VALLEE