Imaging of the respiratory system

Board Review

3/9/21

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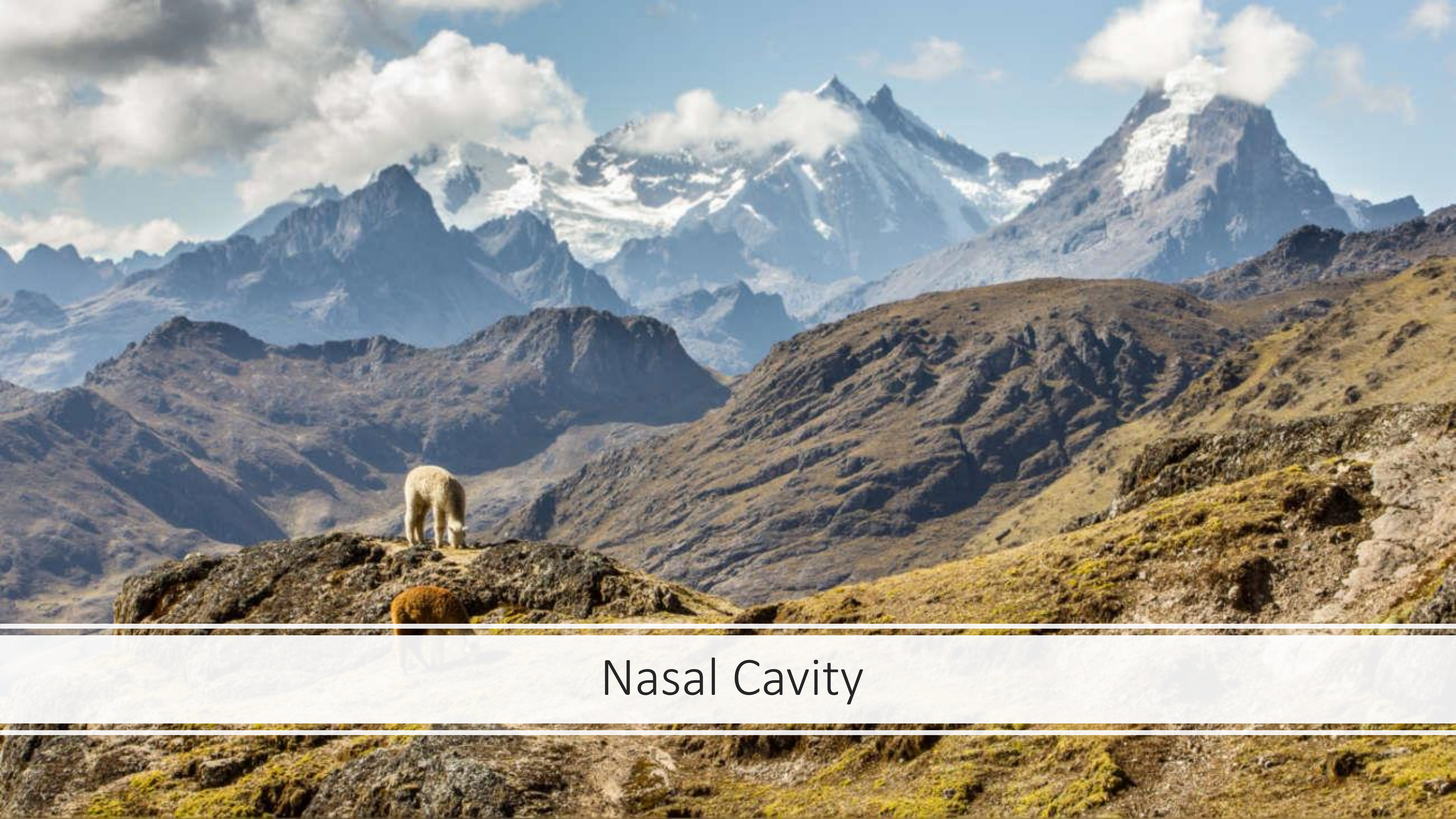
Outline

- Nasal cavity
  - Radiographs
  - CT
- Pharynx, larynx and trachea
  - Radiographs
  - CT
  - Tracheal Collapse and stent
- Thorax
  - Abnormal radiographic patterns
  - Lung lobe Torsion
  - Thoracic Ultrasound – TFAST/Vet BLUE



Nasal Cavity

Nasal cavity - radiographs

- Nasal radiographs can be helpful in localization and characterization of intranasal disease however they rarely identify a specific cause for a disease
- Benefits:
  - ability to detect asymmetry, bony destruction and soft tissue opacity in the nasal cavity and surrounding structures
- Cons:
  - lack of sensitivity
  - poor detail compared to CT or MRI

- https://vetmed.illinois.edu/imaging_anatomy/canine/skull/ex01/c0611_Canvas.html

Nasal cavity – Computed Tomography

- Useful at detecting rhinitis, neoplasia and foreign bodies
- Several studies have described the CT findings of various chronic nasal diseases in detail, with a particular emphasis on neoplasia and rhinitis
- Provides a detailed, 3D view of the nasal cavity, nasopharynx and sinuses
- Test of choice to evaluate nasal diseases
- Excellent for detecting early nasal lesions and for determining the extent of an invasive process
- Usually done prior to rhinoscopy since hemorrhage can affect the CT images

- https://www.imaios.com/en/vet-Anatomy/Dog/Dog-Head-CT

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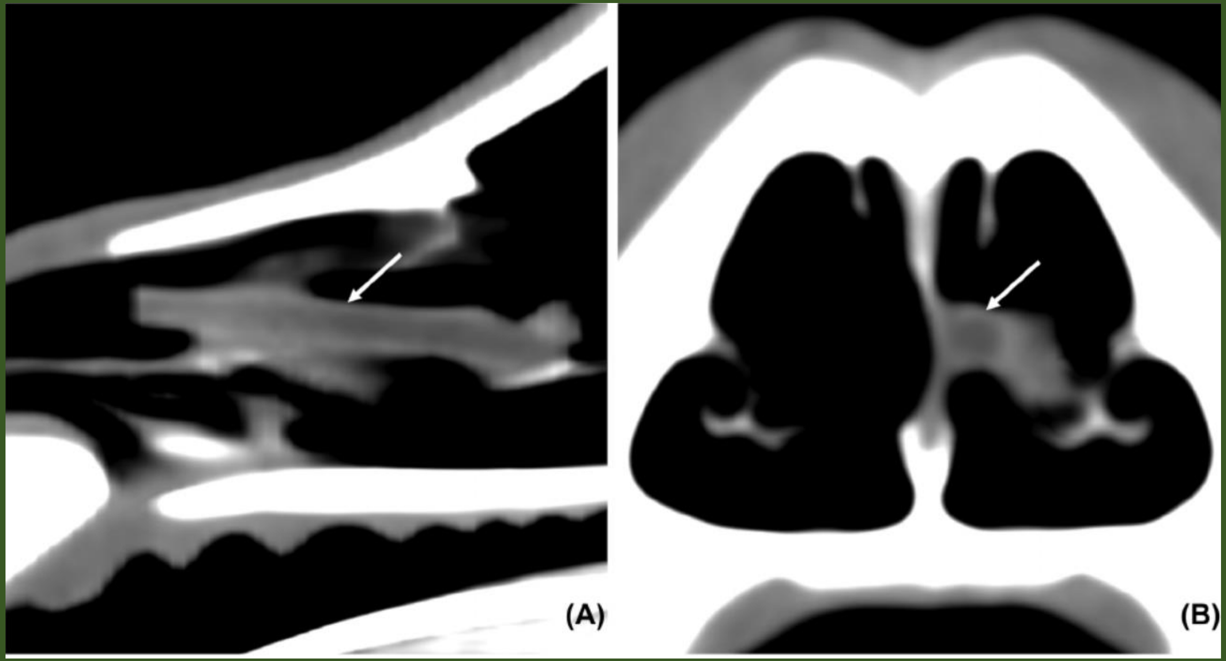
ORIGINAL INVESTIGATION

WILEY

CT findings in 20 dogs and six cats with confirmed nasal foreign bodies

Beatriz Moreno-Aguado[1] | Ines Carrera[2] | Andrew Holdsworth[1] | Petra Agthe[3] |



COMPARISON OF RADIOGRAPHY AND COMPUTED TOMOGRAPHY FOR THE DIAGNOSIS OF CANINE NASAL ASPERGILLOSIS

JIMMY H. SAUNDERS, DVM, HENRI VAN BREE, DVM, PHD

- 25 dogs with Nasal Aspergillosis
- CT had a sensitivity of 88% and radiography of 72%
- The sensitivity was higher in dogs with lesions affecting the entire nasal cavity and frontal sinus on at least one side with a sensitivity of 100% for CT and 90-95% for radiography than in dogs with lesions restricted to the nasal cavities where CT had a sensitivity of 60% and radiography of 40%
- CT was superior to radiography for evaluation of the nasal cavities (mucosal thickening along the nasal bones), frontal sinuses (mucosal thickening along the frontal bone, fluid/soft tissue, frontal bone hyperostosishysis), and differentiation between a cavitated-like or a mass-like process

- CT is more sensitive than radiography for diagnosis of nasal aspergillosis in the dog because of a better demonstration of some changes suggestive of nasal aspergillosis

Subjective Evaluation of Computed Tomography and Magnetic Resonance Imaging for Detecting Intracalvarial Changes in Canine Nasal Neoplasia

- Paired imaging studies consisting of CT and MRI were performed in 8 dogs to evaluate subjectively whether MRI is superior to CT in detecting intracalvarial nasal neoplasia
- No difference noted in detecting intracalvarial changes in the specified structures between CT and MRI
- If MRI is not available, CT images provide valuable clinical information

DIAGNOSTIC VALUE OF COMPUTED TOMOGRAPHY IN DOGS WITH CHRONIC NASAL DISEASE

- This study indicates a high accuracy of CT for diagnosis of dogs with chronic nasal disease

Computed tomography or rhinoscopy as the first-line procedure for suspected nasal tumor: A pilot study

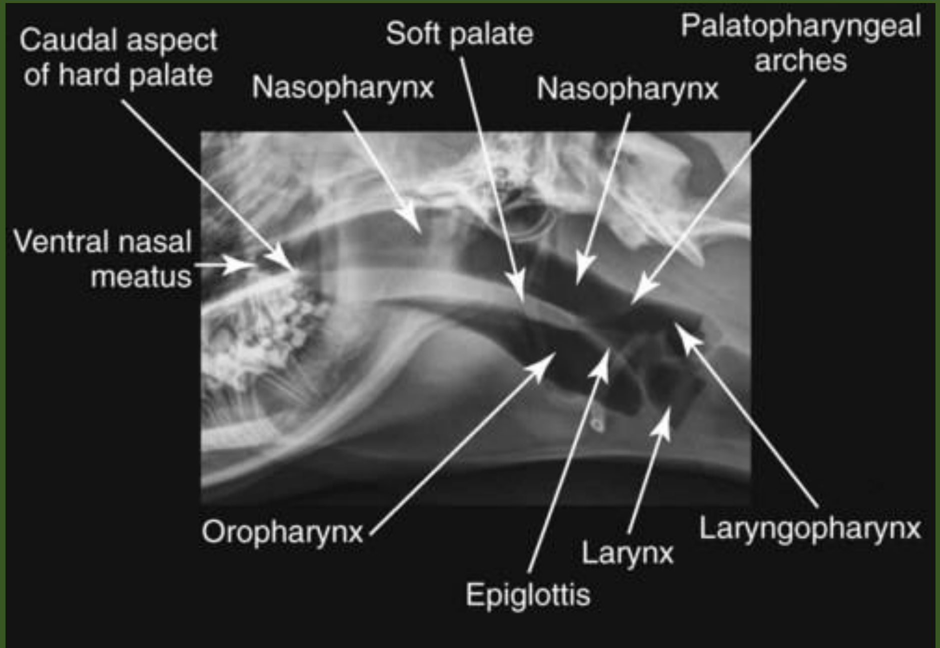
Marlène Finck, Frédérique Ponce, Laurent Guilbaud, Cindy Chervier, Franck Floch, Jean-Luc Cadoré, Thomas Chuzel, Marine Hugonnard

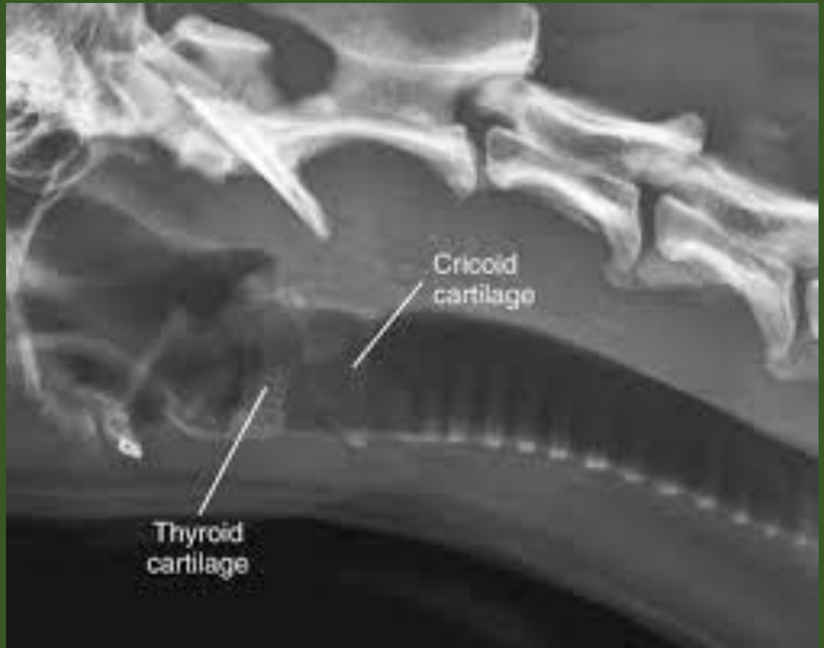
- Computed tomography appeared to be more reliable than rhinoscopy for detecting nasal tumors and should therefore be considered as the first-line procedure

Pharynx, larynx and trachea

Pharynx, larynx and cervical trachea

- Radiographs of the lateral skull or neck are usually adequate when respiratory signs are localized to this areas (stridor, gagging, ineffective coughing, change or loss of voice)
- Images centered over the larynx are most useful in the assessment of laryngeal stridor, while images centered over the mid cervical region are preferred in the assessment of suspected tracheal collapse

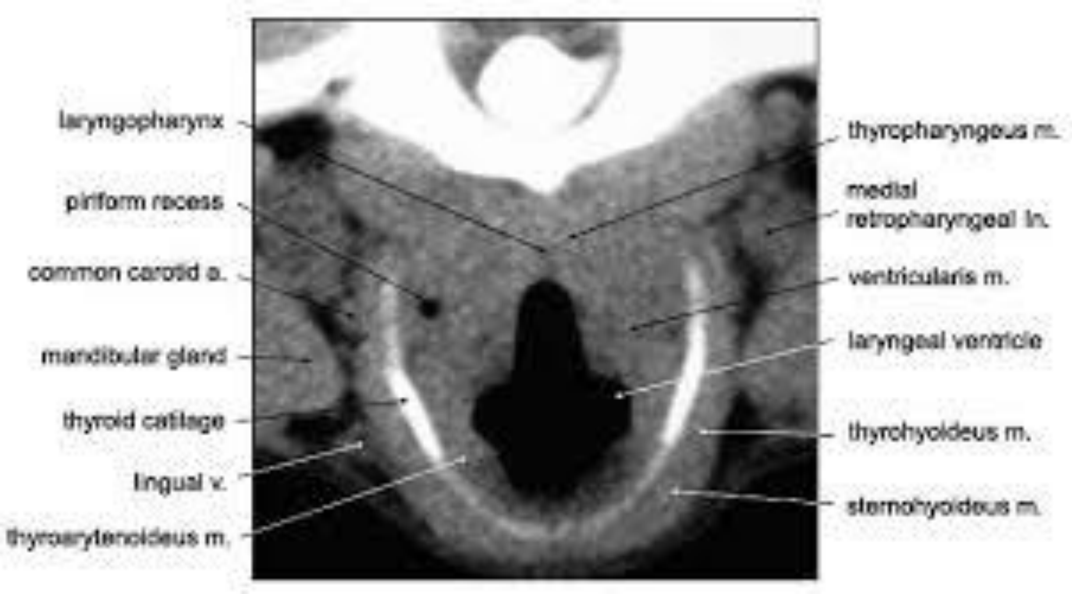




COMPUTED TOMOGRAPHIC IMAGING OF DOGS WITH PRIMARY LARYNGEAL OR TRACHEAL AIRWAY OBSTRUCTION

KRYSTINA STADLER, SUSAN HARTMAN, JODI MATHESON, ROBERT O'BRIEN

- CT imaging of unanesthetized dogs with upper airway obstruction compares favorably with traditional definitive diagnostic methods (Visual laryngeal examination, endoscopy, video fluoroscopy - in this study)



The role of ultrasound in the assessment of laryngeal paralysis in the dog

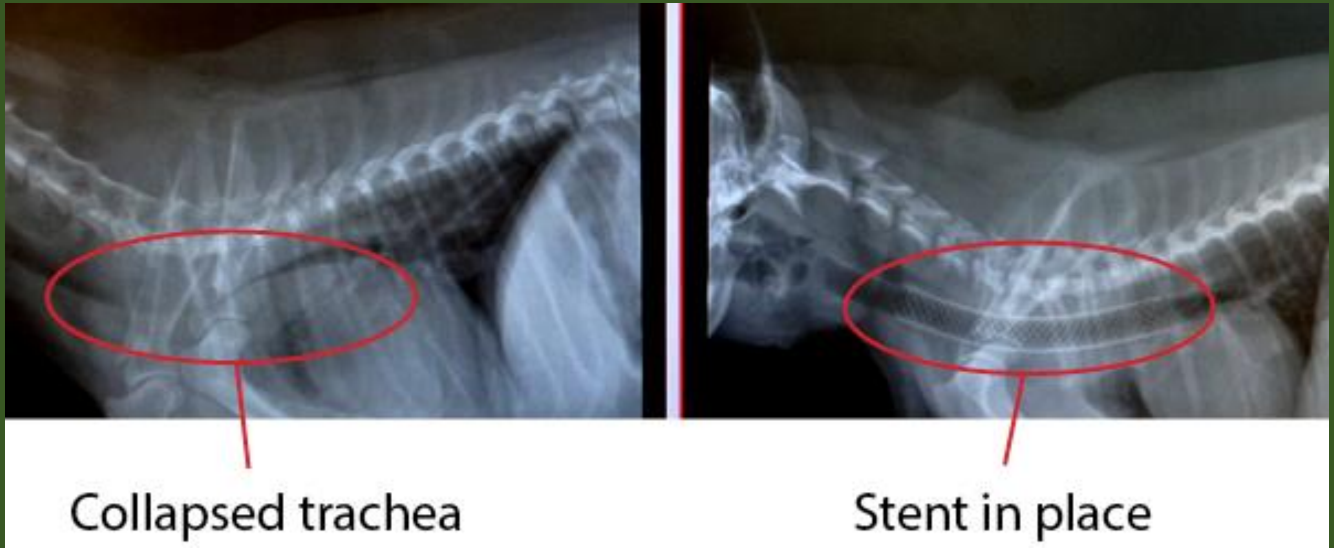
H Rudorf [1], F J Barr, J G Lane

- Laryngoscopy was used as the definitive technique to diagnose laryngeal paralysis
- Ultrasound investigation accurately indicated the presence of the paralysis and confirmed the uni- or bilateral nature of the disorder
- Findings indicative of laryngeal paralysis included:
    - Asymmetry or absence of motion of the cuneiform processes (30/30)
    - Abnormal arytenoid movement (16/30)
    - Paradoxical movement (9/30)
    - Caudal displacement of the larynx (2/30)
    - laryngeal collapse (1/30)

Tracheal Collapse and Stenting

- Tracheal collapse is one of the most common causes of airway obstruction in the small breed dogs
- It is a frequent cause of morbidity and mortality
- It involves a progressive degeneration of the tracheal cartilage (chondromalacia) characterized by dorsoventral flattening of the trachea as well as laxity of the trachealis dorsalis muscle

Tracheal Collapse and Stenting



Tracheal Collapse and Stenting

- Indications for tracheal stent:
  - Quality of life compromise due to respiratory signs
  - Intolerance of medical management of tracheal collapse
  - When hospitalization has been necessary in the past for acute airway obstruction due to tracheal collapse

Fig 4. Anatomy of a self-expanding metallic tracheal stent. Note the hub (H) or cannula. The "Y" piece (Y), the nose cone (N), and the stent (S to S). (Courtesy Infiniti Medical LLC, Menlo Park, CA) (Color version of the figure is available online.)

Tracheal Stenting – How to

- Done under GA
- A large endotracheal tube with radiopaque marking all the way to the tip should be utilized
  - R lateral recumbency, extended neck so the trachea is straight
  - This positioning often aids in identification of the cricoid cartilage
- Head and neck positioning can be confirmed fluoroscopically by ensuring that the wings of the atlas are superimposed on one another
- The entire trachea should be visualized in the field of view (larynx to carina) to aid in measurements
- The endotracheal tube is repositioned just beyond the larynx
- Fluoroscopy will aid in optimal positioning

Tracheal Stenting – How to

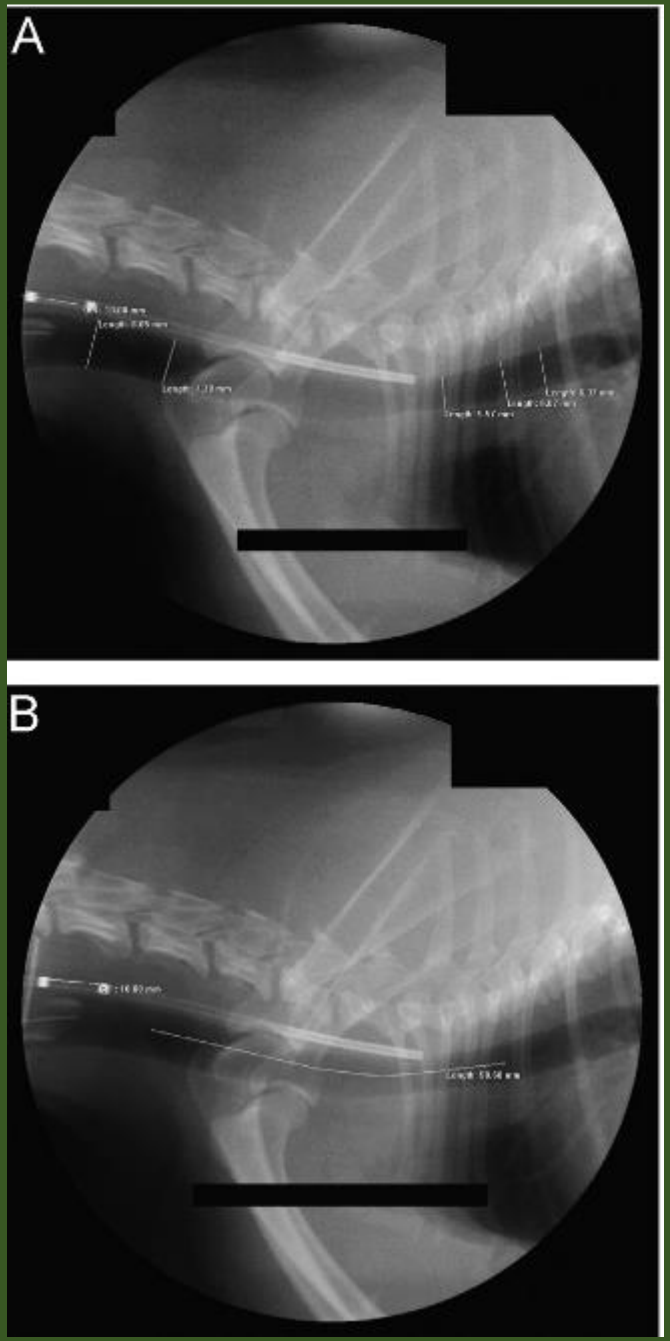
- Using fluoroscopic guidance, a moistened hydrophilic angled-tip guidewire (Weasel Wire) is advanced down the esophagus and into the stomach and a 5-Fr marker catheter is advanced over the guidewire

Tracheal Stenting – How to

- The guidewire is then removed
- The marker catheter has radiopaque markings positioned a set distance from one another and is used to calibrate measuring instruments to compensate for the effects of magnification
- Measurements of tracheal length and diameter are performed during PEEP, stable breath hold at 20 cm H2O and performed in the mid-cervical region, at the thoracic inlet, and at the mid intrathoracic trachea
- If the stent is to span the entire trachea, the measurement should include the distance from 1 cm distal to the cricoid to 1 cm proximal to the carina

Tracheal Stenting – How to

- Stent size?
  - stent diameter should be chosen that is 10%-20% greater than the maximum tracheal diameter as described earlier
  - If the maximum tracheal diameter is 10 mm, then a 12 mm stent is generally chosen
- Why?
  - The trachea is most often slightly conical with the cervical trachea being wider than the intrathoracic trachea
- Because of this, the stent is usually sized appropriately for the cervical trachea, but is technically oversized for the intrathoracic trachea



Tracheal Stenting – How to

- Once the appropriate stent size is chosen, a bronchoscope adapter is applied to the end of the ET tube
  - This allows to deploy the sent and ventilate and supply anesthesia at the same time
- The stent is deployed using fluoroscopic guidance
- First, the distal aspect of the stent is positioned at the predetermined location that is a minimum of 1 cm distal to the region of collapse or 1 cm from the carina
- After the stent is deployed for recovery, one can:
  - Introduce the ET tube into the stent
  - Recover patient without an ET tube

Stent placement complications

- Acute:
  - Stent migration
  - Malpositioning
- Chronic:
  - Foreshortening of the stent
  - Fracture of the stent

Immediate, short-, and long-term changes in tracheal stent diameter, length, and positioning after placement in dogs with tracheal collapse syndrome

Matthew Raske[1] | Chick Weisse[1] | Allyson C. Berent[1] | Renee McDougall[1] | Kenneth Lamb[2]

- Retrospective, 50 dogs
- Immediate mean percentage change was 5.14%, 5.49%, and 21.64% for cervical, thoracic inlet, and intra-thoracic tracheal diameters, respectively
- Initial mean stent length was 26.72% higher than nominal length and ultimate long-term tracheal mean stent shortening was only 9.90%
- No significant stent migration was identified in the immediate, short-, or long-term periods
- Minimal stent shortening with no clinically relevant stent migration after fluoroscopic placement
- Precise stent sizing and placement techniques likely play important roles in avoiding these reported complications

Bacterial infection before and after stent placement in dogs with tracheal collapse syndrome

Sylvia Lesnikowski[1] | Chick Weisse[2] | Allyson Berent[2] | Alexandre Le Roux[2] | Erik Tozier[3]

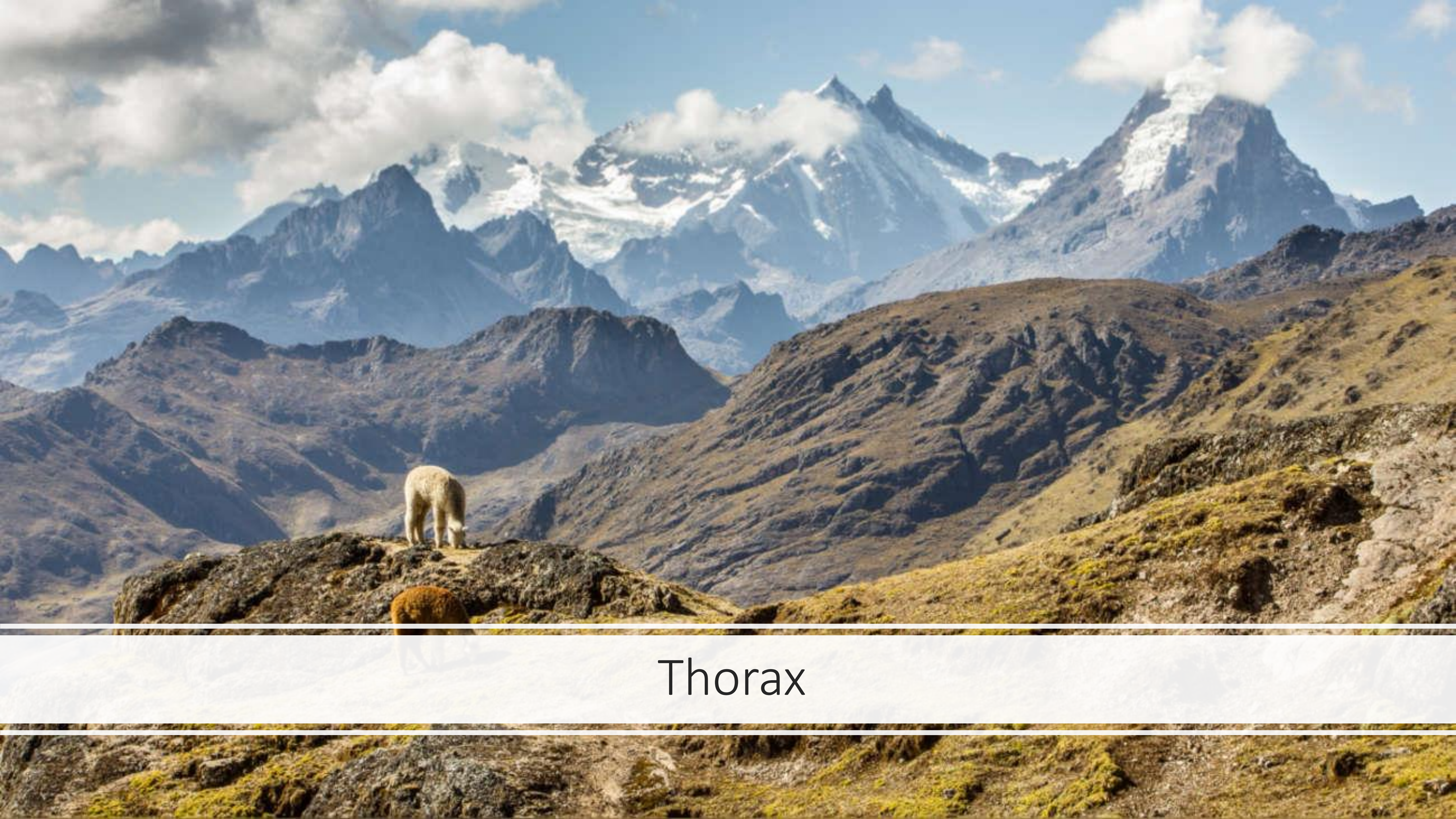
- There was no difference between the overall prevalence of dogs with positive bacterial cultures before (82%) or after stent placement (77%)
- Tracheal stent placement does not increase the overall rate of pathogenic bacterial infection in dogs with tracheal collapse and can decrease the rate of subsequent pathogenic infections in geriatric dogs and dogs with TTC that require tracheal stenting
- Airway culture and cytology should be performed in all dogs undergoing tracheal stent placement

Correlations among tracheal dimensions, tracheal stent dimensions, and major complications after endoluminal stenting of tracheal collapse syndrome in dogs

Nathaniel P. Violette[1] | Chick Weisse[1] | Allyson C. Berent[1] | Kenneth E. Lamb[2]

- Retrospective, 52 dogs
- Major complications included:
  - stent fracture (25%)
  - obstructive tissue ingrowth (19%)
  - progressive tracheal collapse (12%)

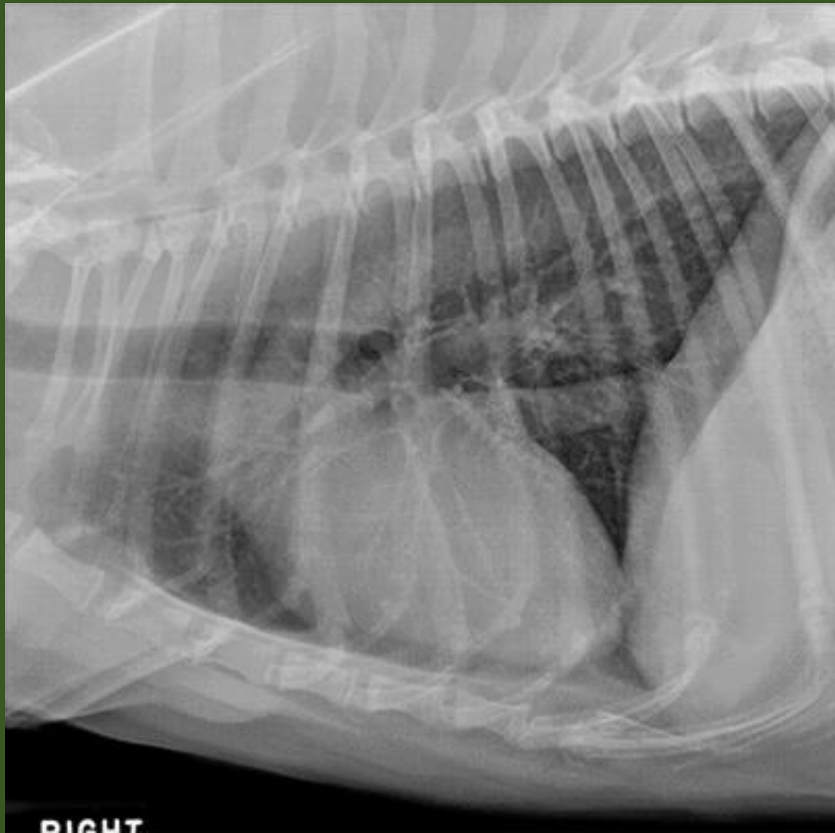
- Natural tracheal taper and more stent diameter oversizing in the intrathoracic trachea were associated with caudodorsal stent fracture
- Only stents with a 14-mm nominal diameter fractured
- Progressive tracheal collapse was associated with smaller maximum tracheal diameters
- The majority of dogs with obstructive tissue ingrowth (70%) and all dogs with thoracic inlet fractures (100%) had tracheal malformations



Thorax

Thorax

- Two orthogonal views may aid in localizing lower airway, parenchymal and pleural space conditions
- Views should be collimated to include the entire pulmonary fields, the cranial abdomen and the thoracic inlet



Thorax: radiographic abnormal patterns

- Interstitial: further characterized as unstructured or structured (nodular)
- Vessels might be fuzzy but still visible
- Unstructured patterns have a generalized increased in pulmonary parenchymal opacity and a decreased distinction of the pulmonary vasculature
  - Common causes: viral or hematogenous pneumonia, pulmonary edema (cardiogenic and non-cardiogenic), neoplastic infiltration and pneumonitis
    - Nodular interstitial patterns: Metastasis, mycosis, primary tumors, bullae

Pulmonary Eosinophilic Bronchopneumopathy

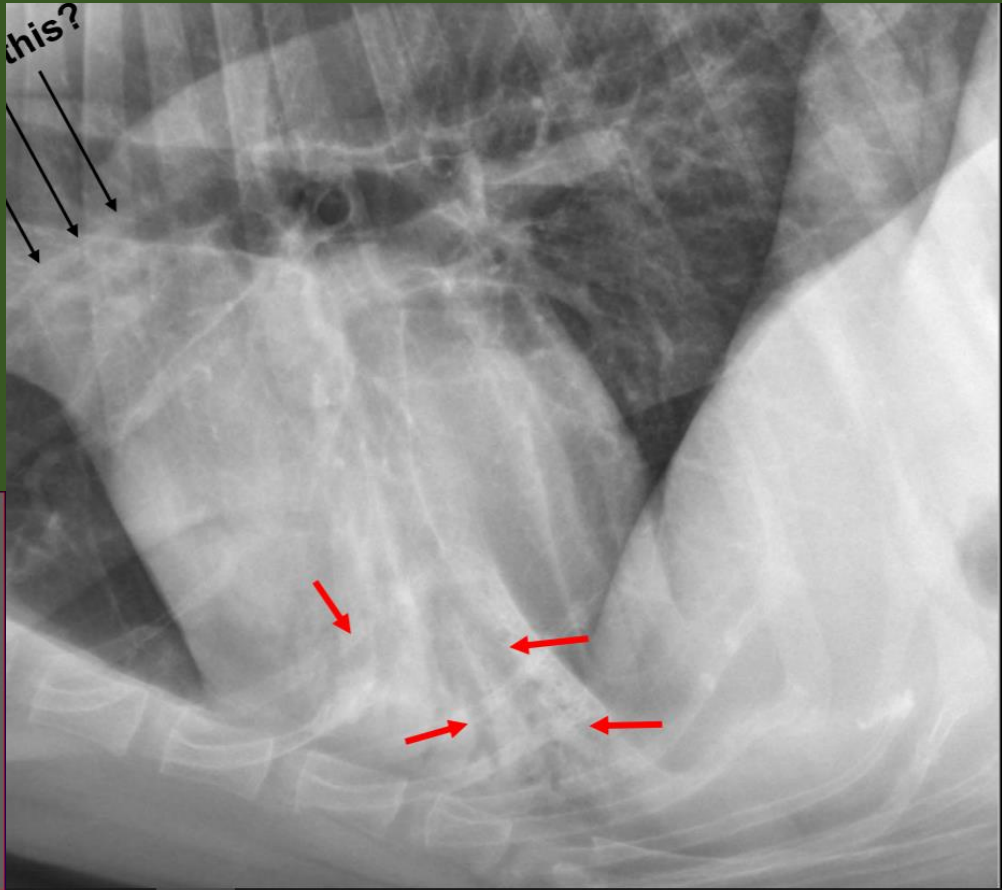
WBC (thou/uL)	**25.1 (H)**
Segmented Neutrophils (thou/uL)	**14.6 (H)**
Band Neutrophils (thou/uL)	0.0
Lymphocytes (thou/uL)	**0.3 (L)**
Monocytes (thou/uL)	0.8
Eosinophils (thou/uL)	**8.3 (H)**

Thorax: radiographic abnormal patterns

- Alveolar: the air within the alveoli is replaced with soft tissue or fluid, resulting in overall increased lung opacity

- Pulmonary edema, hemorrhage and inflammatory or neoplastic exudates are fluids that can replace alveolar air resulting in an alveolar pattern

  - Radiographic hallmark: air bronchograms, a lobar sign and soft tissue silhouetting between affected lung and the diaphragm, heart or vasculature. Vessels are completely obscured
  - Causes: bronchopneumonia, pulmonary edema, hemorrhage and atelectasis



Thorax: radiographic abnormal patterns

- Bronchial: when the bronchial walls become thickened or when the immediate peribronchial space becomes infiltrated with cells or fluid
    - Radiographic hallmark: thickened bronchi appear as rings of soft tissue density with air opacity in the center (donuts) or parallel radioopaque lines (tram-lines)
    - Causes: allergic airway disease (feline asthma, canine eosinophillic bronchopneumopathy), parasitic bronchitis/pneumonitis and chronic bronchitis

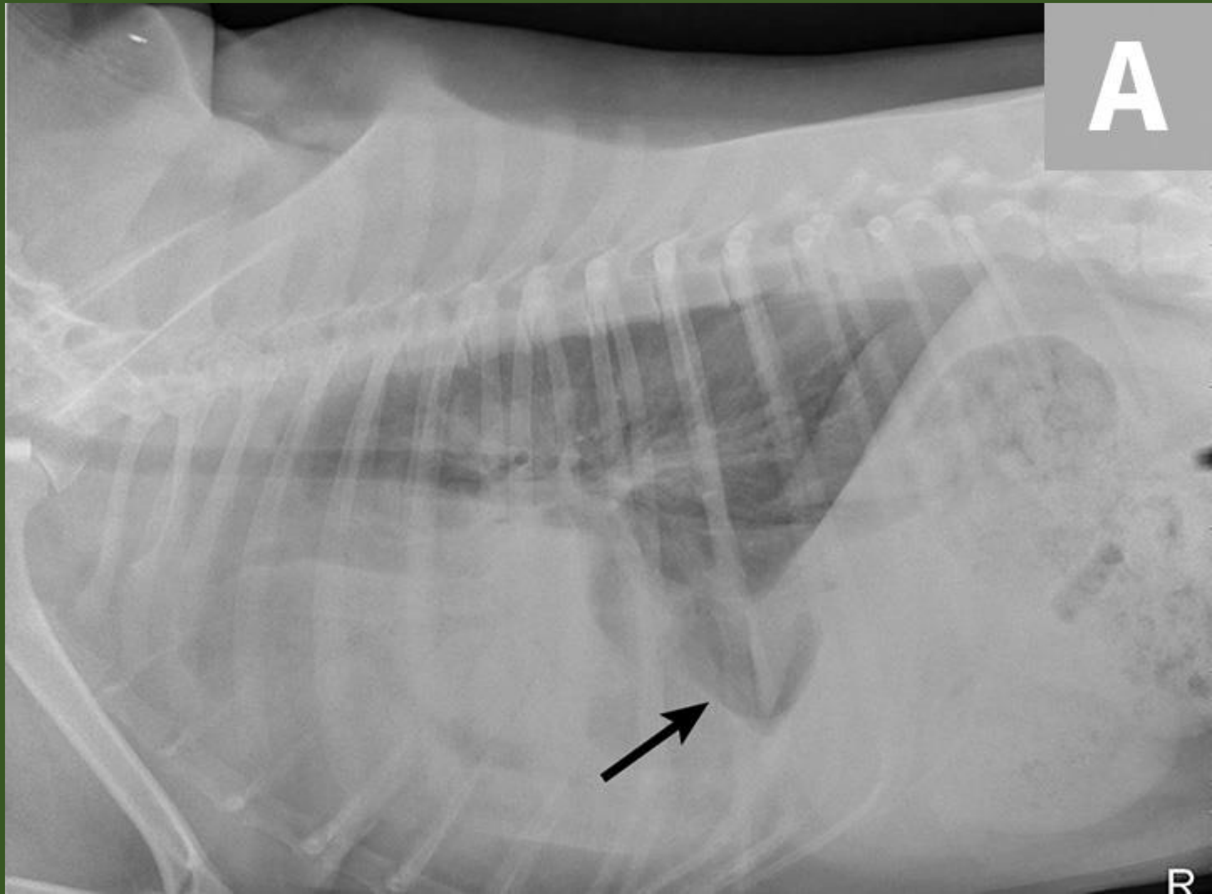
Thorax:

Pleural effusion:

- Accumulation of fluid within the pleural space can inhibit lung expansion leading to respiratory difficulty, hypoxemia due to hypoventilation and respiratory distress

- About 100 mls of liquid must be present within the pleural space of a medium-sized dog before it becomes apparent on rads. Smaller volumes or localized accumulations may require additional imaging modalities to be detected

- Radiographic signs: appearance of pleural fissures lines between lung lobes, retraction of the lobes away from the chest, rounding of the edges of dependent lung lobes and obfuscation of the diaphragmatic and cardiac silhouettes

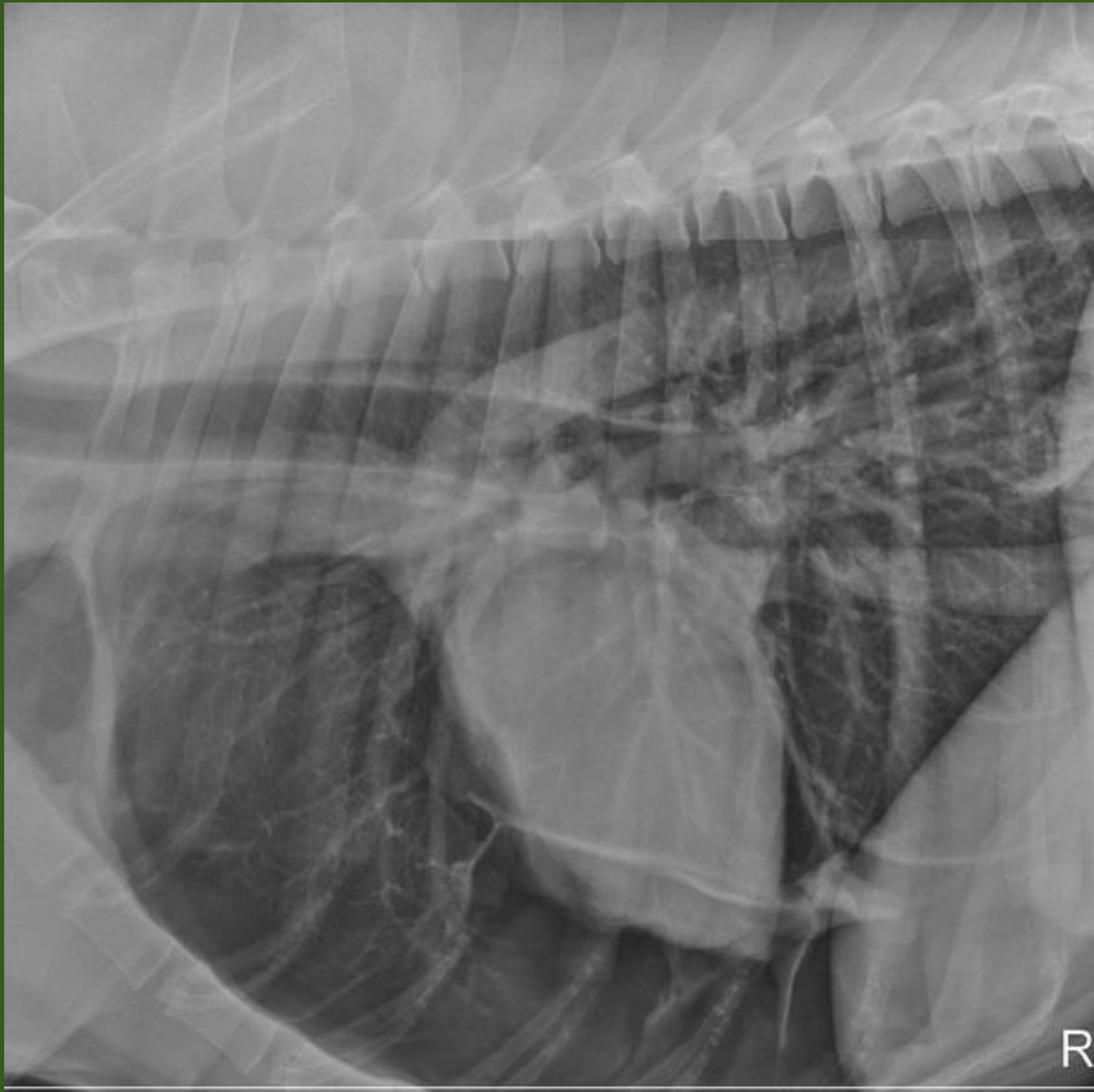


Thorax:

Pneumothorax:

- Air or other gases can cause severe respiratory distress

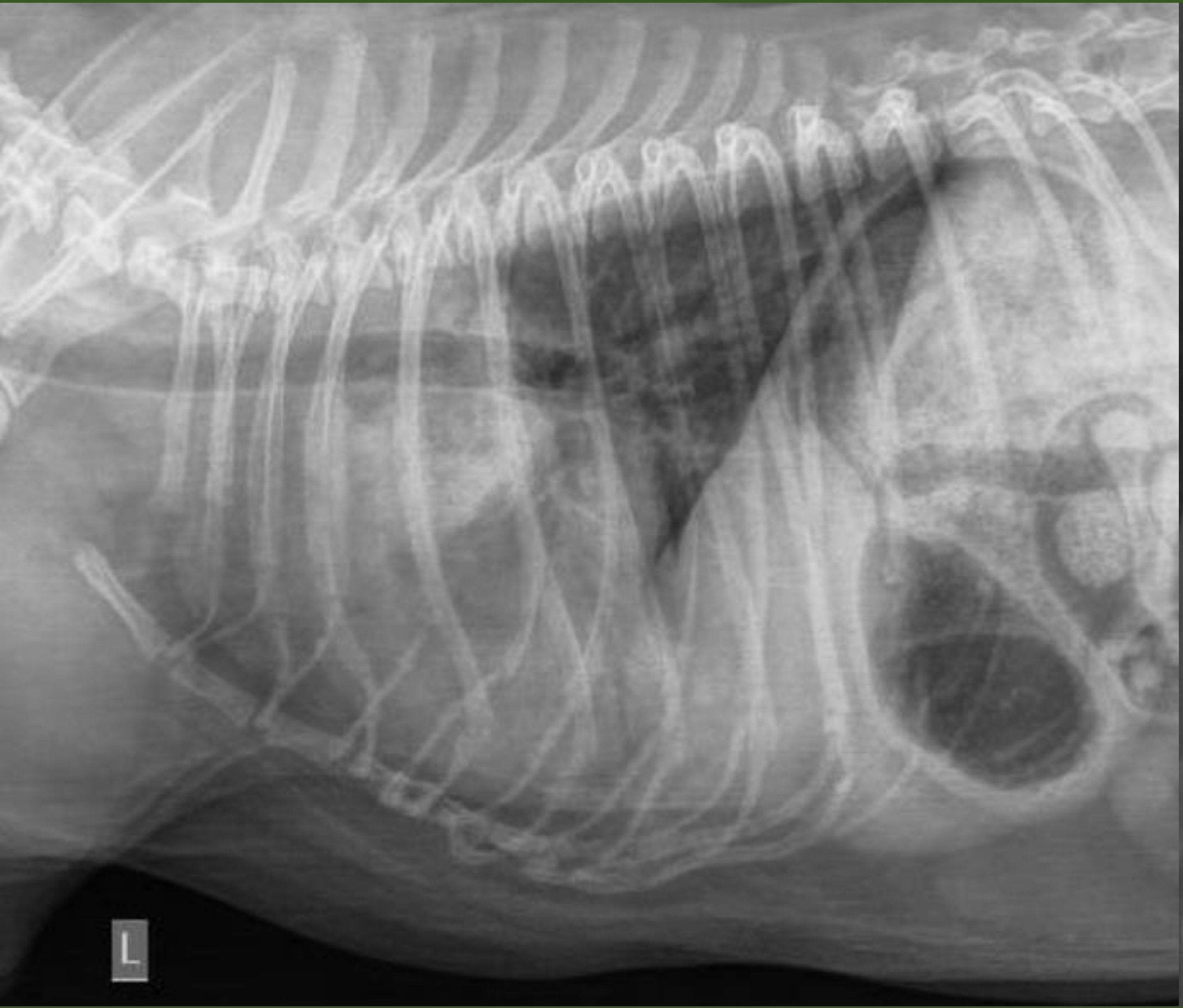
- Radiographic: retraction of the lungs away from the thoracic wall on lateral views, loss of lung opacity
  - Collapse of the dependent lung lobe on the lateral views allows the heart to descend into the dependent hemithorax, resulting in a separation of the heart and the sternum - resulting in the ‘Floating heart image’

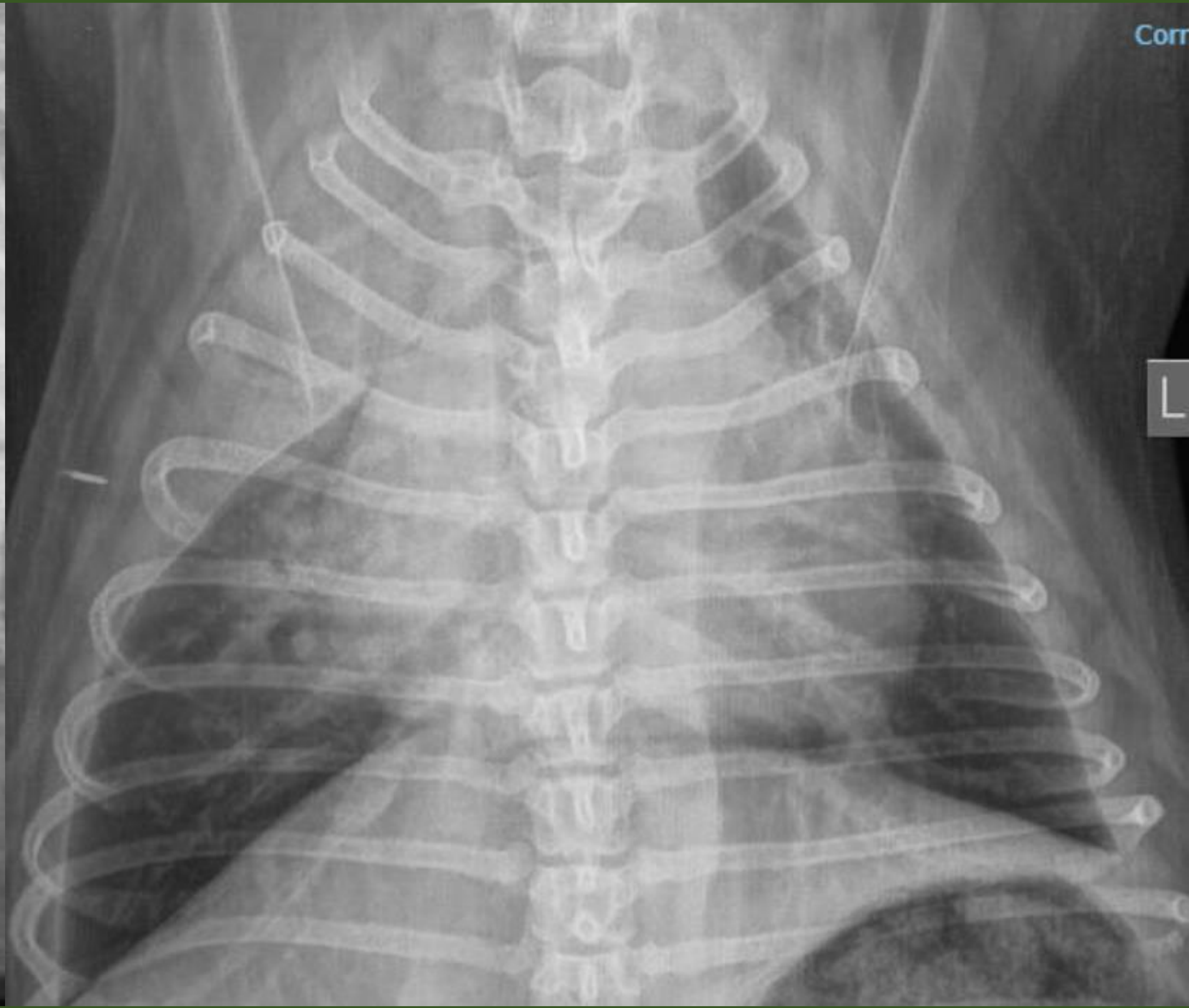


Lung Lobe Torsion

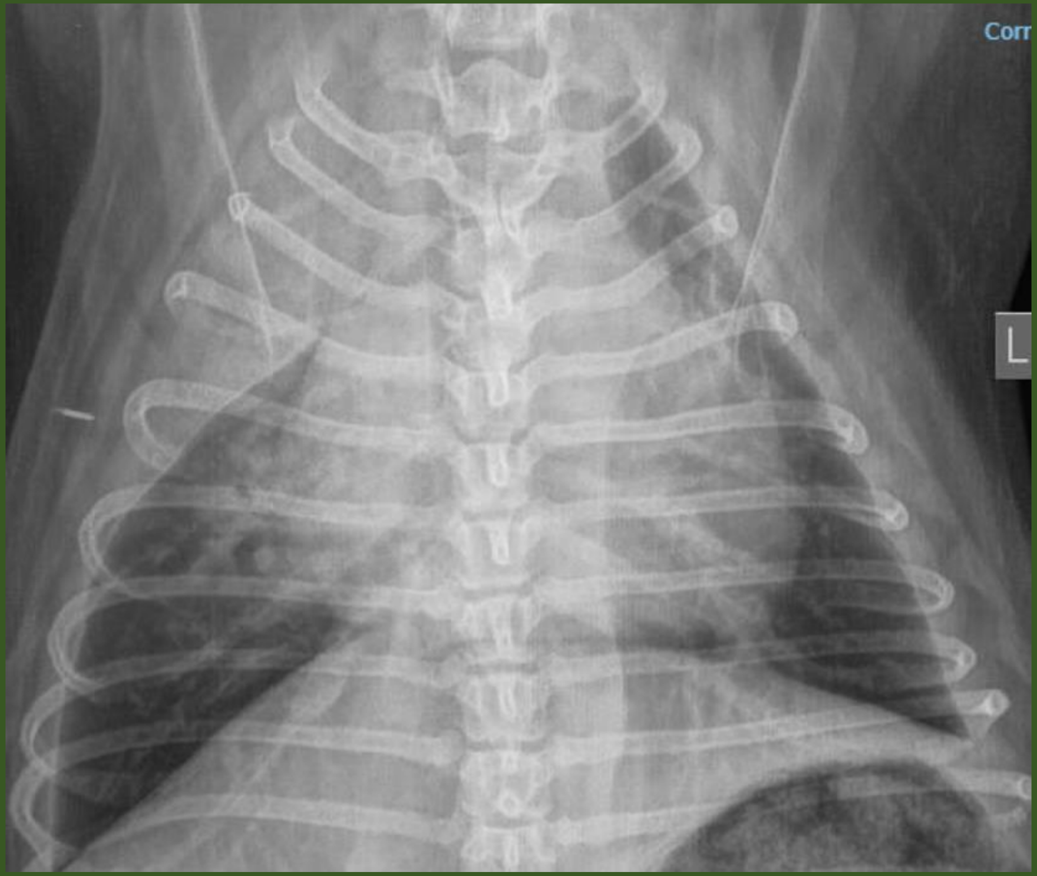
- Main radiographic findings
  - Consolidation of the affected lobe
  - Pleural effusion
  - Mediastinal shift
  - Focal narrowing of the affected bronchus

Lung Lobe Torsion





Lung Lobe Torsion



- Minimum intensity projection (MinIP) is a data visualization method that enables detection of low-density structures in a given volume
- Optimal tool for the detection, localization, and quantification of ground-glass opacity, mosaic attenuation, traction bronchiectasis, cystic lung disease and linear attenuation patterns

Long-term survival after treatment of idiopathic lung lobe torsion in 80 cases

Matteo Rossanese DVM, SPSA, CertAVP, MSc, MRCVS[1] |
Brandan Wustefeld-Janssens BSc (Agric), BVSc (Hons), CertAVP, DECVS, MRCVS[2] |
Cleo Price BVSc, MRCVS[3] | Ben Mielke BVSc (Hons), MRCVS[4] |
Samantha Woods BSc MA, VetMB, CertSAS, DECVS, FHEA, MRCVS[5] |
Nicola Kulendra BVetMed, CertVDI, DECVS, MRCVS[6] |
Guillaume Chanoit DEDV, MSc, PhD, DACVS, DECVS, FHEA[7]

- Most common breeds: pugs (47.5%) and sighthounds (16.2%)
- Causes: primary in 77%, secondary in 21%, and unknown in 2% of dogs
- Overall long-term survival after lung lobectomy for LLT was excellent
- CT was the most common diagnostic tool used to diagnose LLT - Performed in 69 (86%) cases
  - Most common abnormalities:
    - obliteration or tapering of the main bronchus 68%
    - Pleural effusion 65%
    - Vesicular pattern of the affected lung lobe 59%
    - Lung consolidation 27%
    - local lymphadenopathy 17%
    - atelectasis 13%
    - Emphysema 10%

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- Thoracic radiography was performed in 24% cases
    - Most commonly reported features:
        - Increased radiopacity
        - Focal narrowing of the affected bronchus
        - Pleural effusion
- Lobes affected: left cranial lung lobe 50%, right middle 35%, right cranial 16%, and accessory 1%

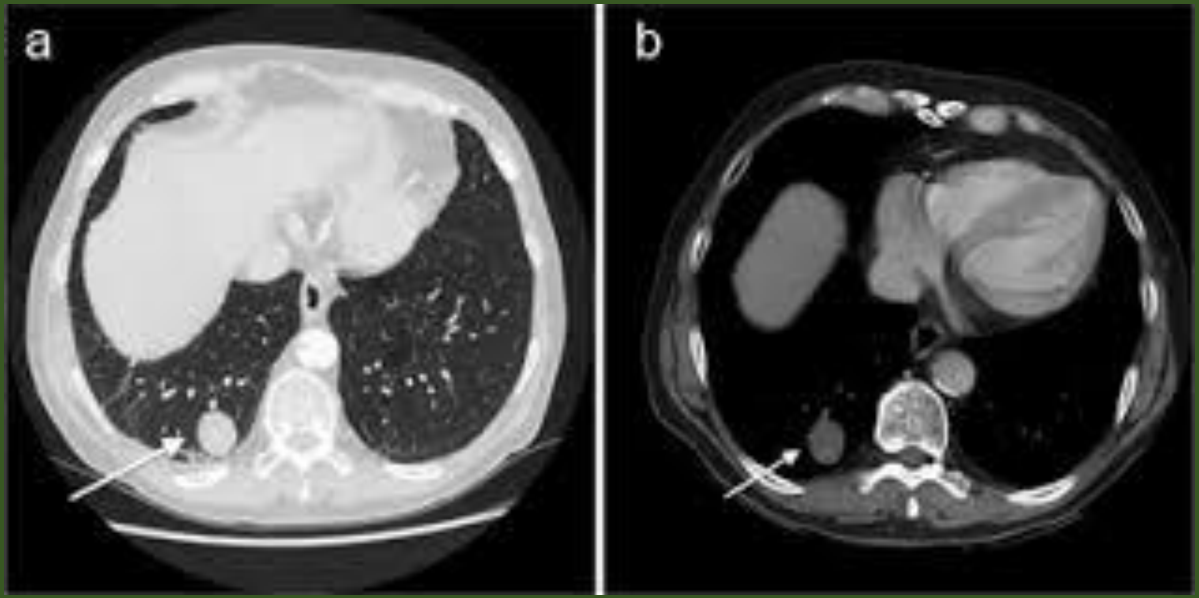
Lung lobe torsion in dogs: 52 cases (2005–2017)

Karen M. Park DVM[1,2] | Janet A. Grimes DVM, MS, DACVS-SA[1] | Mandy L. Wallace DVM, MS, DACVS-SA[1] | Allyson A. Sterman DVM[3] | Kelley M. Thieman Mankin DVM, MS, DACVS-SA[3] | Bonnie G. Campbell DVM, PhD, DACVS[4] | Erin E. Flannery BS[5] | Milan Milovancev DVM, DACVS-SA[5] | Kyle G. Mathews DVM, MS, DACVS[2] | Chad W. Schmiedt DVM, DACVS-SA[1]

- **The short- and long-term prognosis was excellent with surgical treatment of lung lobe torsion**
- Thoracic radiographs findings:
    - consolidation of the affected lobe
    - pleural effusion
    - Mediastinal shift
    - Focal narrowing of the affected bronchus
- CT also reveals consolidation and emphysema of the affected lobe, pleural effusion, an abrupt bronchial ending, and a contralateral mediastinal shift

Thoracic Computed Tomography

- Enhanced ability to detect and localize subtle pulmonary, mediastinal and thoracic wall lesions that may contribute to respiratory signs
- Provides a better contrast between adjacent opacities and has higher sensitivity to changes in density within a given opacity
- Can detect nodules as small as 1 mm (rads cannot see smaller than 7-9 mm)
- Severity of CT findings may closely correlate with pulmonary functional abnormalities and disease severity



Thoracic Ultrasonography – TFAST exam

- Sensitivity and specificity for detection of pneumothorax is about than 95% using x-rays as gold standard
- What can TFAST do?
    - Rapid detection of pneumothorax in trauma patients
    - Determination of the degree or severity of pneumothorax as partial vs massive by finding the lung point
    - Detection of:
        - pleural effusion
        - lung contusions
        - pericardial effusions
        - thoracic wall, pleural space and lung pathology through the presence of the step sign
    - Assessment of contractility and volume status
    - Assessment of left sided cardiac status when combined with Vet BLUE

Thoracic Ultrasonography – TFAST exam

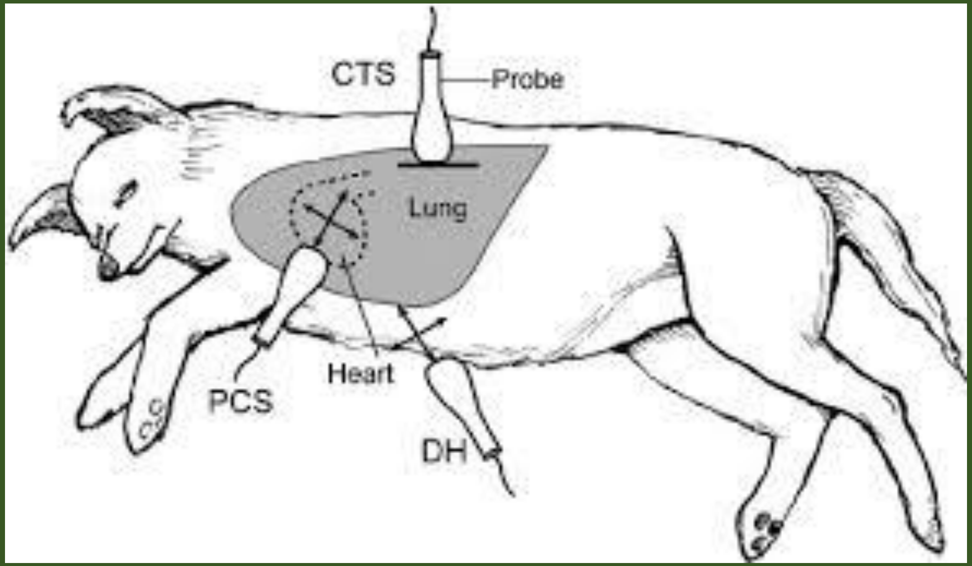
- Indications for TFAST
    - Blunt and penetrating trauma
    - All forms of respiratory distress
    - Monitoring pneumothorax
    - Determining the degree of pneumothorax
    - Monitoring pleural and pericardial effusive conditions

Thoracic Ultrasonography – TFAST exam

- Objectives of the TFAST:
  - Rapidly diagnose pneumothorax
  - Identify the lung point
  - Determine the presence of pleural and pericardial space conditions
  - Identify basic lung conditions
  - Assess patient volume status

Thoracic Ultrasonography – TFAST exam

- How to perform a TFAST
  - Right lateral recumbency is preferred because it is the standard positioning for echo and it is more reliable for caudal vena cava, gallbladder and hepatic venous imaging
  - This positioning allows ⅚ TFAST views
  - The patient is then moved to sternal recumbency for CTS view and Vet BLUE



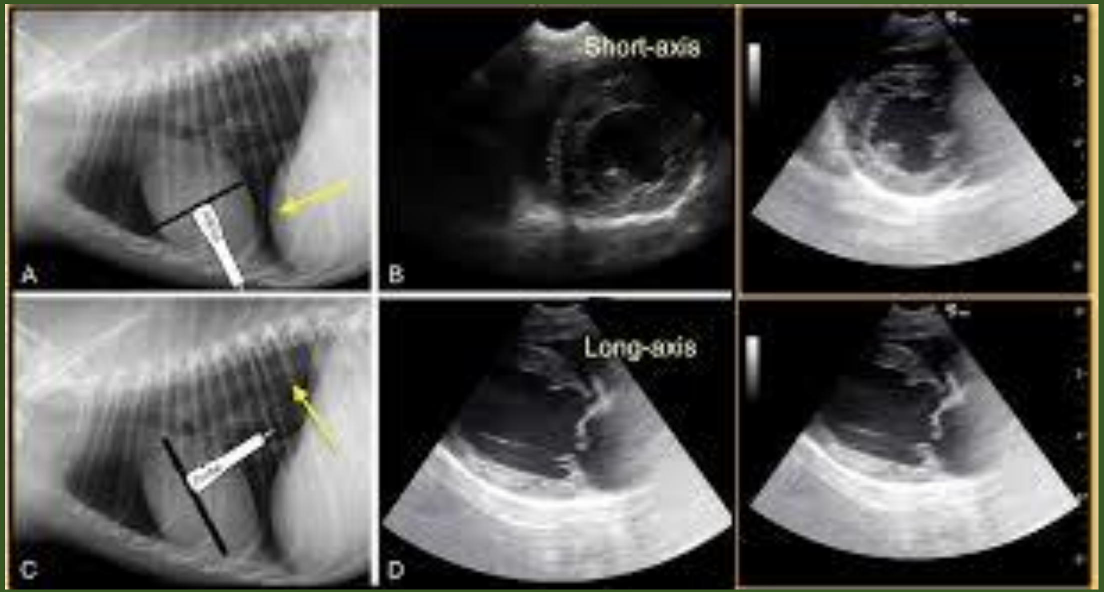
Thoracic Ultrasonography – TFAST exam

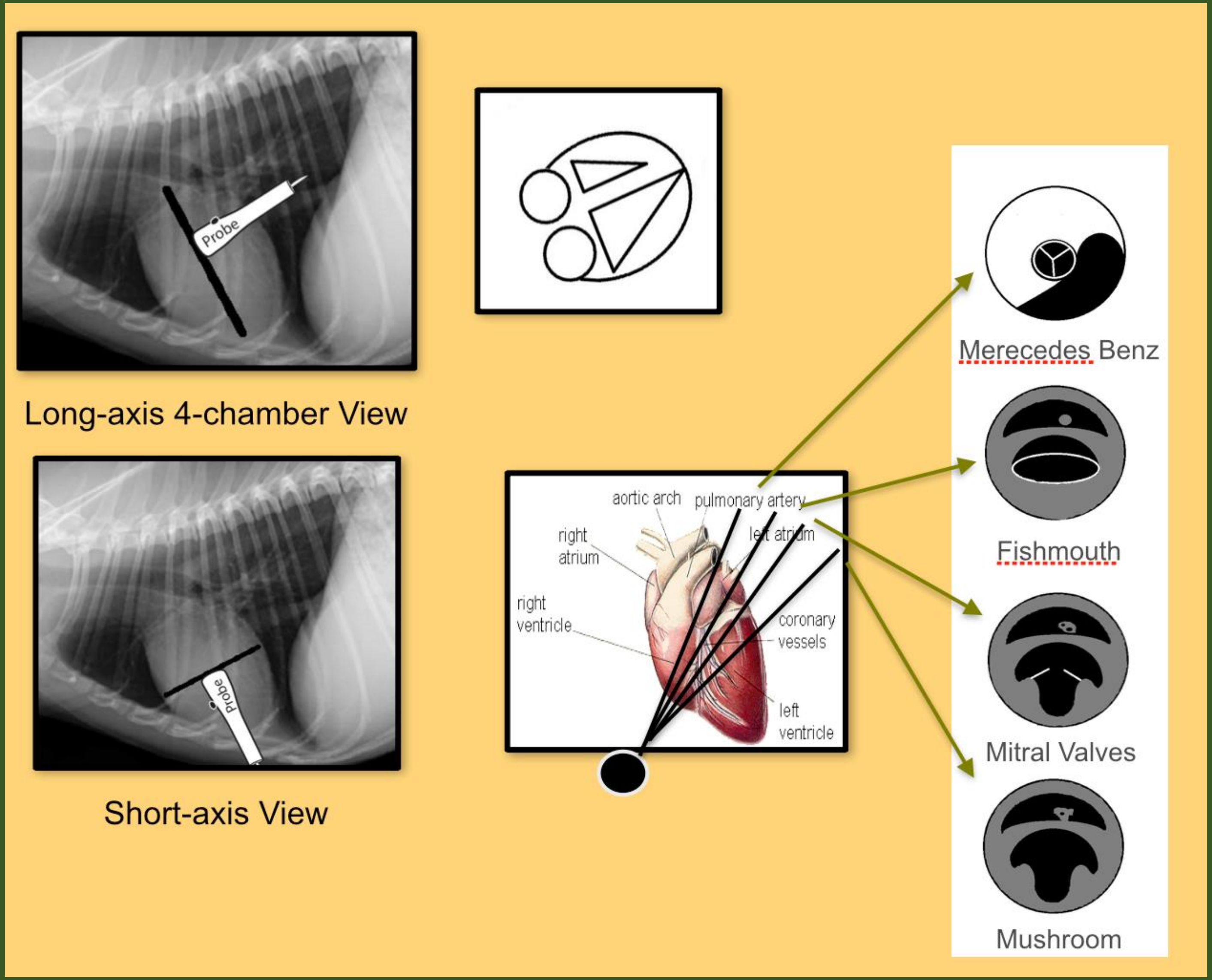
- 5 Points of TFAST:

  - Chest tube site (x2)
  - Used for diagnosis of pneumothorax

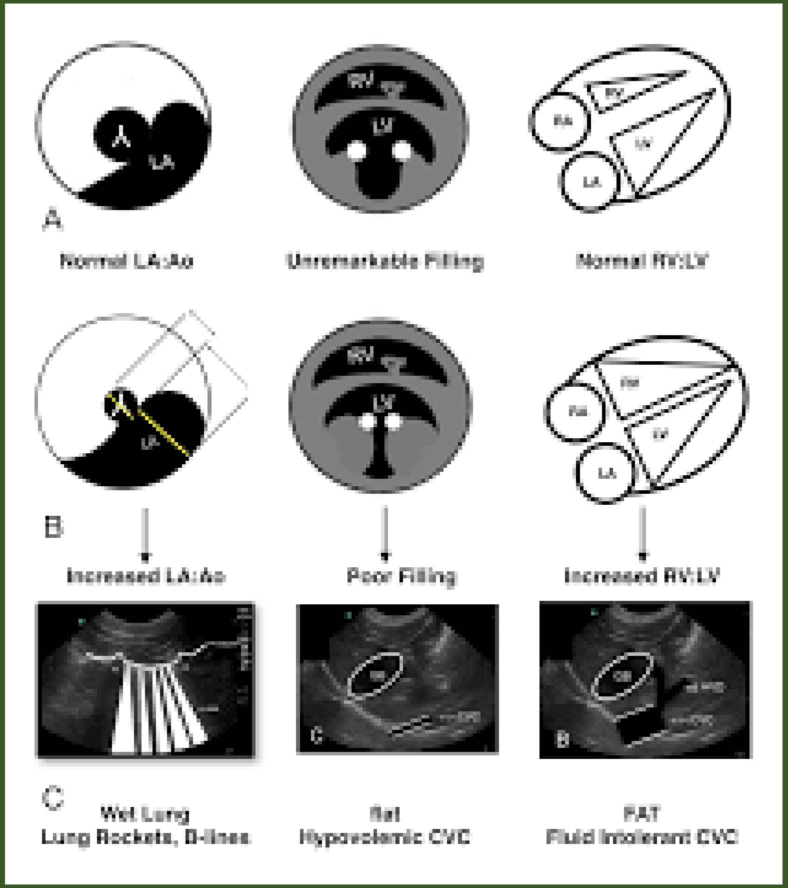
  - PCS (x2)
  - Useful for imaging the heart
  - Marker towards the elbow - marker towards the spine
  - Left ventricular short axis view - mushroom view allows to assess contractility and volume status and LA/Ao

  - DH view
  - Very useful at visualizing the pericardial sac
  - Caudal vena cava and hepatic veins can be evaluated





Probe
Long-axis 4-chamber View
Probe
Short-axis View
aortic arch
pulmonary artery
right atrium
left atrium
right ventricle
coronary vessels
left ventricle
Merecedes Benz
Fishmouth
Mitral Valves
Mushroom



A
Normal LA:Ao
Unremarkable Filling
Normal RV:LV
B
Increased LA:Ao
Poor Filling
Increased RV:LV
C
Wet Lung
Lung Rockets, B-lines
flat
Hypovolemic CVC
FAT
Fluid Intolerant CVC

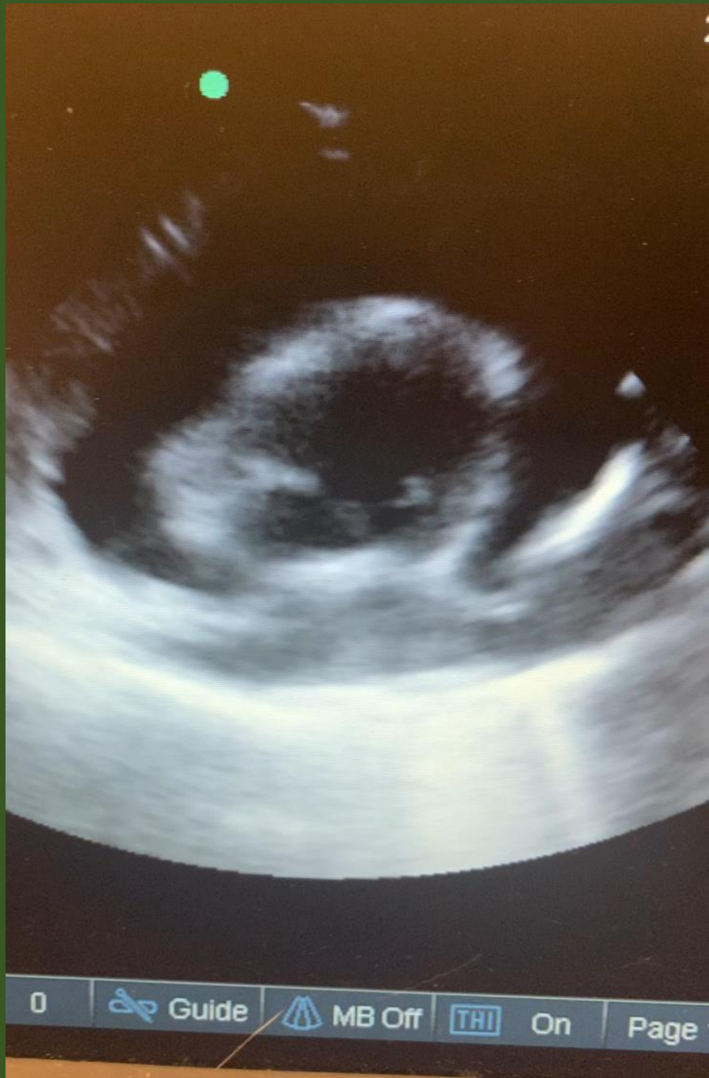
Thoracic Ultrasonography – TFAST exam

- Determining Pleural from Pericardial effusion
  - “One view is no view”
  - By using multiple views (at least PCS and DH), mistakes are less likely to happen
  - Zoom out - increase depth, move away from the suspected fluid so that the heart it is seen in its entirety
  - Look for that hyperechoic pericardial sac that typically will be marginated from the cardiac silhouette in circular or oval fashion in the short and long axis views
  - Then move to the DH view to look for further evidence of pericardial effusion
  - Move to the other PCS if still unclear

Thoracic Ultrasonography – TFAST exam

Determining the presence of cardiac tamponade

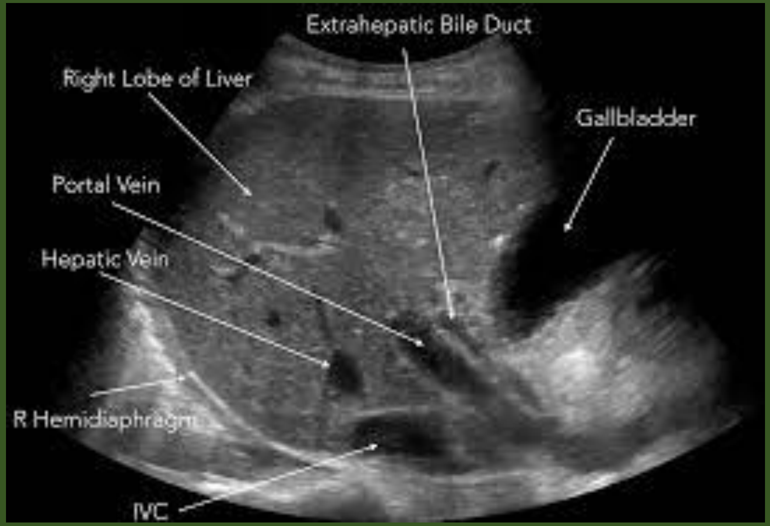
- Life threatening condition that occurs when intrapericardial pressure exceeds the filling pressure of the right atrium and ventricle
- It may be observed in PCS and DH view or combination
- The collapse of the right ventricular or right atrial free wall in the short or long axis are classic and often easily recognizable signs
- The subxiphoid view is the preferred first-line screening test for the detection of PE and cardiac tamponade during FAST exams in people



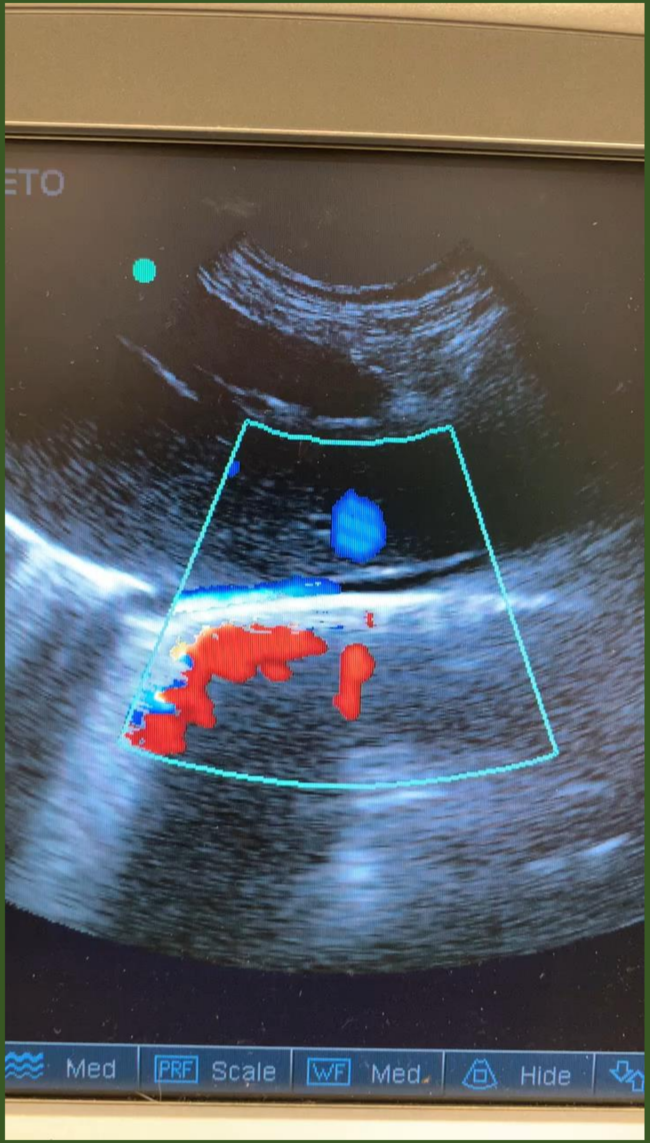
Thoracic Ultrasonography – TFAST exam

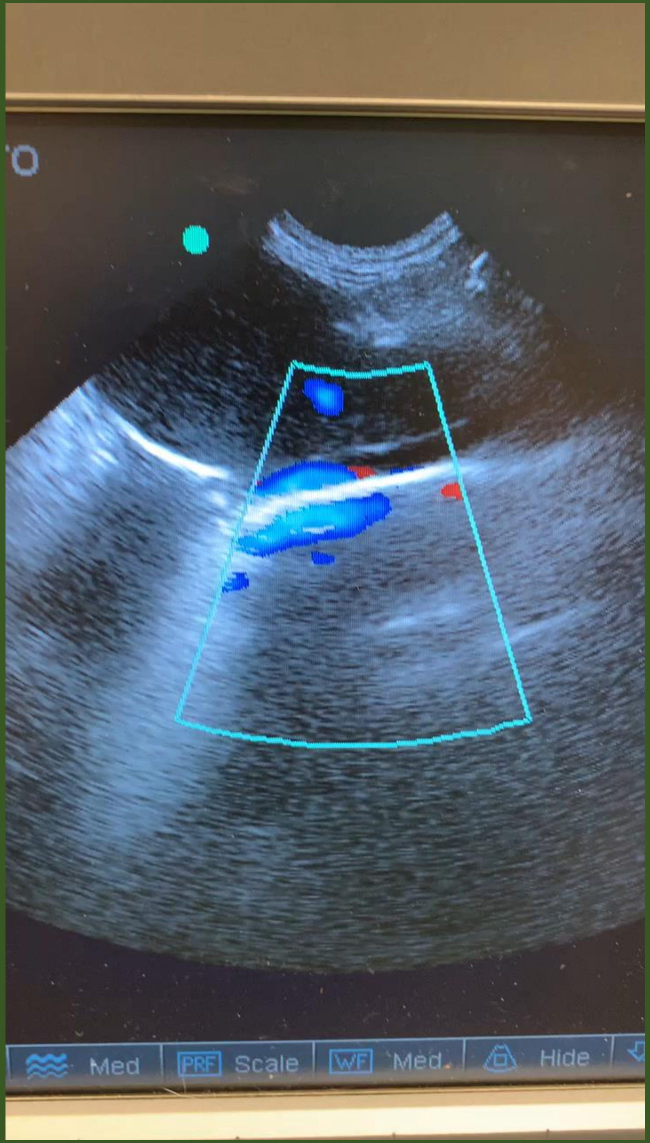
Evaluation of the caudal vena cava

- Subxiphoid view
  - The transducer was placed longitudinally under the subxiphoid process and angled cranially to visualize the diaphragm. The ultrasound probe then fanned to the right of midline until the CVC could be identified at the point it crosses the diaphragm
- Hepatic view
  - Locate the porta hepatis - the transducer is placed parallel to the ribs (transverse to the CVC and aorta) at the 10th-12th right ICS approximately just below the epaxial muscles in the upper third of the thorax
  - A transverse image of the porta hepatis is obtained
  - Images are considered adequate whenever artifacts secondary to air in the lungs or gas in the gastrointestinal tract are absent and the aorta, CVC, and portal vein were visualized in a single frame



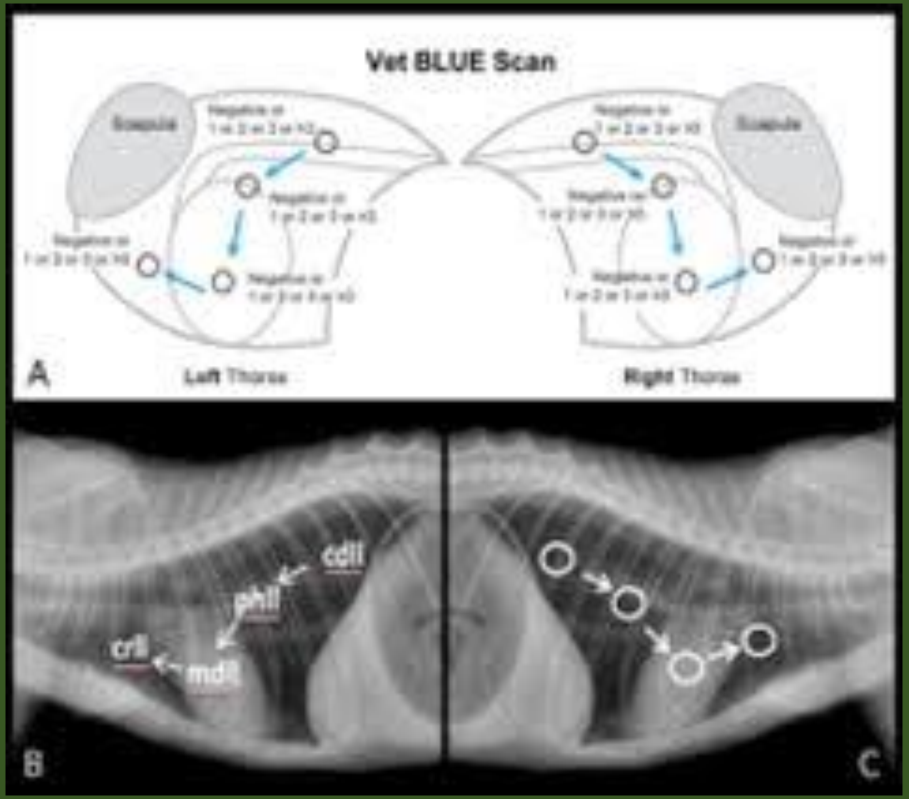
Subxyphoid view of CVC pre and post fluid bolus





Thoracic Ultrasonography – Vet BLUE exam

- Vet BLUE (Bedside Lung Ultrasound Examination)
  - Extension of TFAST serves to increase the sensitivity and specificity of intrathoracic conditions
  - Designed so that regionally based ultrasonographic findings may correlate to thoracic radiographs
  - Useful in dogs and cats for classifying respiratory vs non-respiratory causes as well as discriminating between lower and upper airway conditions
  - Can be done in sternal recumbency or standing
  - Four regional lung localizations:
    - Caudodorsal lung lobe region: dorsal to the xiphoid between the 8th and 9th ICS near the highest point of the thorax (Same as CTS)
    - Perihilar lung lobe region: the point of mid-thorax between 6th and 7th ICS
    - Middle lung lobe region: The lower thorax over the heart between 4th and 5ft ICS
    - Cranial lung lobe region: 2nd to 3rd ICS cranial to the heart



The use of the diaphragmatico-hepatic (DH) views of the abdominal and thoracic focused assessment with sonography for triage (AFAST/TFAST) examinations for the detection of pericardial effusion in 24 dogs (2011–2012)

Gregory R. Lisciandro, DVM, DABVP, DACVECC

- The subxiphoid view is the preferred first-line screen-ing test for the detection of PE and cardiac tamponade during FAST exams in people
- 24 dogs were diagnosed with PE by FAST with entries for the DH view
- Of the 24 dogs, 7 had abdominal FAST, 6 had TFAST, and 11 had both exams performed
- PE was noted on the DH view in 83% cases

- The DH view of FAST was found to be clinically helpful for the detection of PE

Evaluation of a thoracic focused assessment with sonography for trauma (TFAST) protocol to detect pneumothorax and concurrent thoracic injury in 145 traumatized dogs

Gregory R. Lisciandro, DVM, DABVP, Michael S. Lagutchik, DVM, MS, DACVECC, Kelly A. Mann, DVM, MS, DACVR, Andra K. Voges, DVM, DAVCR, Geoffrey T. Fosgate, DVM, PhD, DACVPM, Elizabeth G. Tiller, DVM, Nic R. Cabano, DVM, Leslie D. Bauer, DVM and Bradley P. Book, DVM, DABVP

- Goal: To estimate the relative accuracy of a TFAST protocol for rapid diagnosis of pneumothorax and other thoracic injury in traumatized dogs
- Compared TFAST findings with CXR prospectively
- Overall sensitivity, specificity, and accuracy of TFAST relative to CXR were 78.1%, 93.4%, and 90.0%
- Se and Sp: higher in dogs with penetrating trauma (93.3%, 96.0%) and for the evaluator with the most clinical experience (95.2%, 96.0%)

- TFAST has the potential to rapidly diagnose PTX and other thoracic injury and guide therapy, including potentially life-saving interventions, in traumatized dogs

Evaluation of the agreement between focused assessment with sonography for trauma (AFAST/TFAST) and computed tomography in dogs and cats with recent trauma

Andrea M. Walters, DVM, MS, DACVECC; Mauria A. O'Brien, DVM, DACVECC;
Laura E. Selmic, BVetMed (Hons), MRCVS, DACVS; Sue Hartman, RT(R)CT;
Maureen McMichael, DVM, DACVECC and Robert T. O'Brien, DVM, MS, DACVR

- Goal: To determine the agreement between focused assessment with TFAST exams and CT for the detection of pleural and peritoneal fluid and pneumothorax in animals that have sustained recent trauma
- The median time to perform all 3 exams was 55 minutes (range 30–150 min)
- There was moderate to excellent agreement between AFAST and CT for detection of free peritoneal fluid
- Fair to moderate agreement between TFAST and CT for detection of pleural free fluid

- Poor agreement between TFAST and CT for detection of pneumothorax

Caudal vena cava collapsibility index as a tool to predict fluid responsiveness in dogs

Pablo A. Donati MS, DVM[1] | Juan M. Guevara DVM[1] | Victoria Ardiles MS, MD[2] | Eliana C. Guillemi PhD, DVM[1] | Leonel Londoño DVM[3] | Arnaldo Dubin PhD, MD[4]

- Goal: evaluate the use of the caudal vena cava collapsibility index as a predictor of fluid responsiveness in hospitalized, critically ill dogs with hemodynamic or tissue perfusion abnormalities
- 27 critically ill dogs - spontaneously breathing, with hemodynamic compromise

- US measurement: CVCCI, performed at baseline; and velocity time integral (VTI) of the subaortic blood flow, carried out before and after a fluid load
- VTI: velocity time integral - looks at the area under the curve - looking for CO
- Dogs in which VTI increased 15% were considered fluid responders
- The CVCCI accurately predicted fluid responsiveness with an area under the receiver operating characteristic curve of 0.96
- At baseline, fluid responders had lower VTI than non-responders

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- The CVC was examined from a right transhepatic window approach: the transducer was carefully placed in the area between the right caudal lung lobe and the right kidney, with effort to minimize patient compression
- Measurement of the maximum (expiratory) and minimum (inspiratory) diameters was performed without including endothelial borders (inner method)

- CVCCI formula: (max diameter-min diameter)/maximum diameter × 100

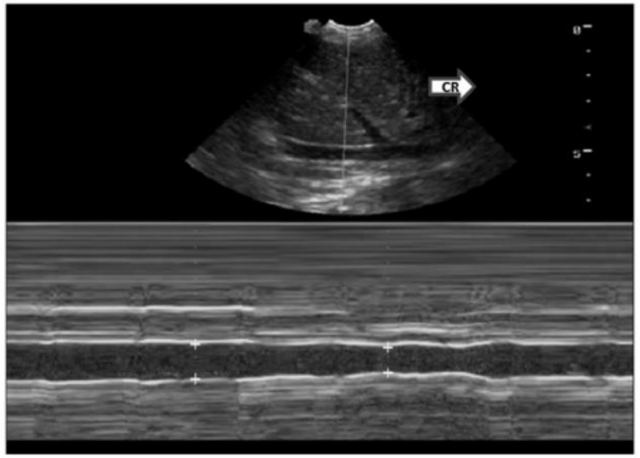

FIGURE 3 Measurement of the maximum and minimum diameter of the caudal vena cava using the inner method by ultrasonographic M mode. The M mode is placed near to the insertion of the right hepatic vein into the caudal vena cava. Cr, cranial

FIGURE 2 Dog in left lateral recumbency. The transducer captures the image from a right transhepatic approach

Caudal vena cava collapsibility index as a tool to predict fluid responsiveness in dogs

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- CVCCI noninvasive, inexpensive, and widely available
- CVCCI allows for better prediction of fluid responsiveness than static variables in human patients
- Patients in which VTI increased by 15% were considered fluid responders
- Total of 27 dogs were evaluated; 77.8% were categorized as fluid responders and 22.2% as non-responders
- The VTI before fluid expansion was significantly lower in responders

- The CVCCI was significantly higher in dogs responsive to fluids compared to those that were not responsive

Focused cardiac ultrasound and point-of-care NT-proBNP assay in the emergency room for differentiation of cardiac and noncardiac causes of respiratory distress in cats

Cassandra Ostroski Janson DVM, DACVECC | Melanie J. Hezzell MA, VetMB, PhD, DACVIM | Mark A. Oyama DVM, MSCE, DACVIM | Benjamin Harries VMD | Kenneth J. Drobatz DVM, MSCE, DACVIM, DACVECC | Erica L. Reineke VMD, DACVECC

- To assess the accuracy of TFAST and NT-proBNP in ER setting for differentiation of cardiac from non cardiaccauses of respiratory distress in cats
- Prospective - 40 cats - 3 cats excluded
- Clinicians made a diagnosis of cardiac vs non-cardiac based on PE and hx
- Then they did a TFAST + Pro-BNP
- Then they compared results to echo
- The accuracy of the ECC clinician diagnoses was calculated against a “reference standard” diagnosis made by a cardiologist
- 21 cardiac and 16 noncardiac cases - (LA:Ao) measured by TFAST was significantly correlated with LA:Ao measured by echocardiography
- Emergency clinicians correctly diagnosed 73.0% - high agreement between TFAST and echo findings
- Five noncardiac and 5 cardiac cats were misdiagnosed
- The BNP yielded an overall percent agreement = 32/34 (94.1%), in differentiating cardiac versus noncardiac cases

- TFAST evaluation of basic cardiac structure and LA:Ao by trained emergency clinicians improved accuracy of diagnosis compared to PE in cats with respiratory distress

Investigation of focused cardiac ultrasound in the emergency room for differentiation of respiratory and cardiac causes of respiratory distress in dogs

Melanie J. Hezzell MA, VetMB, PhD, DACVIM | Cassandra Ostroski DVM, DACVECC | Mark A. Oyama DVM, DACVIM | Benjamin Harries VMD | Kenneth J. Drobatz DVM, MS, DACVECC | Erica L. Reineke VMD, DACVECC

- Goal: To determine whether TFAST by DACVECC or residents improves differentiation of cardiac versus non-cardiac causes of respiratory distress in dogs compared to medical history and PE alone
- Prospective - 38 dogs
- Medical history, physical examination, and TFAST were obtained at presentation
- ECC clinicians categorized each patient (C vs NC) before and after TFAST
- CXR (within 3 h) and echocardiography (within 24 h) performed
- Percent agreement was calculated against a reference diagnosis that relied on agreement of a cardiologist and ECC specialist with access to all diagnostic test results
- 22 dogs with C and 13 dogs with NC causes of respiratory distress
- In 3 dogs a reference diagnosis was not established
- Prior to TFAST, positive and negative percent agreement to detect cardiac causes was 90.9% and 53.9%, respectively
- Overall agreement occurred in 27 of 35 dogs (77.1%)
- Following TFAST, positive and negative percent agreement to detect cardiac causes was 95.5% and 69.2%, respectively
- Overall agreement occurred in 30 of 35 dogs (85.7%). Three dogs with discrepant pre-TFAST diagnoses were correctly re-categorized post-TFAST

- **TFAST did not significantly improve differentiation of C vs NC causes of respiratory distress compared to medical history and PE alone**

Thank you!