Vet BLUE® Lung Ultrasound in Small Animals - The New Way to Do Respiratory Distress

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USE OF LUNG ULTRASOUND IN SMALL ANIMALS - THE VET BLUE

The reluctance to proactively apply LUS to small animals with respiratory distress is irrational in many respects. The overriding belief that air-filled lung creates insurmountable obstacles, and the continued belief in small animal medicine that imaging lung is difficult to perform, leading to mistakes, perpetuate LUS delayed use in small animal veterinary medicine. Thoracic FAST called TFAST (2008) was the first standardized abbreviated veterinary ultrasound exam of the thorax that included the chest tube site (CTS) for lung surveillance for detection of PTX and lung contusions. However, because of the finding of lung pathology found during TFAST, the author extended lung surveillance from the TFAST CTS with the addition of 6 more lung views applied to nontrauma subsets of small animals. The name of this novel, regionally based LUS exam has been studied and published by Lisciandro and colleagues in 2014 as the Vet BLUE protocol ("Vet" for veterinary and "BLUE" for cyanosis and bedside lung ultrasound exam or in emergency).

THE BASICS OF VET BLUE

Patient Preparation

Generally no Vet BLUE sites are shaved! All images shown by the author are unshaved sites at which the fur is parted and alcohol is applied to the skin and a small amount of acoustic gel or alcohol-based hand sanitizer to the probe head. No images from cases in this talk were shaved.

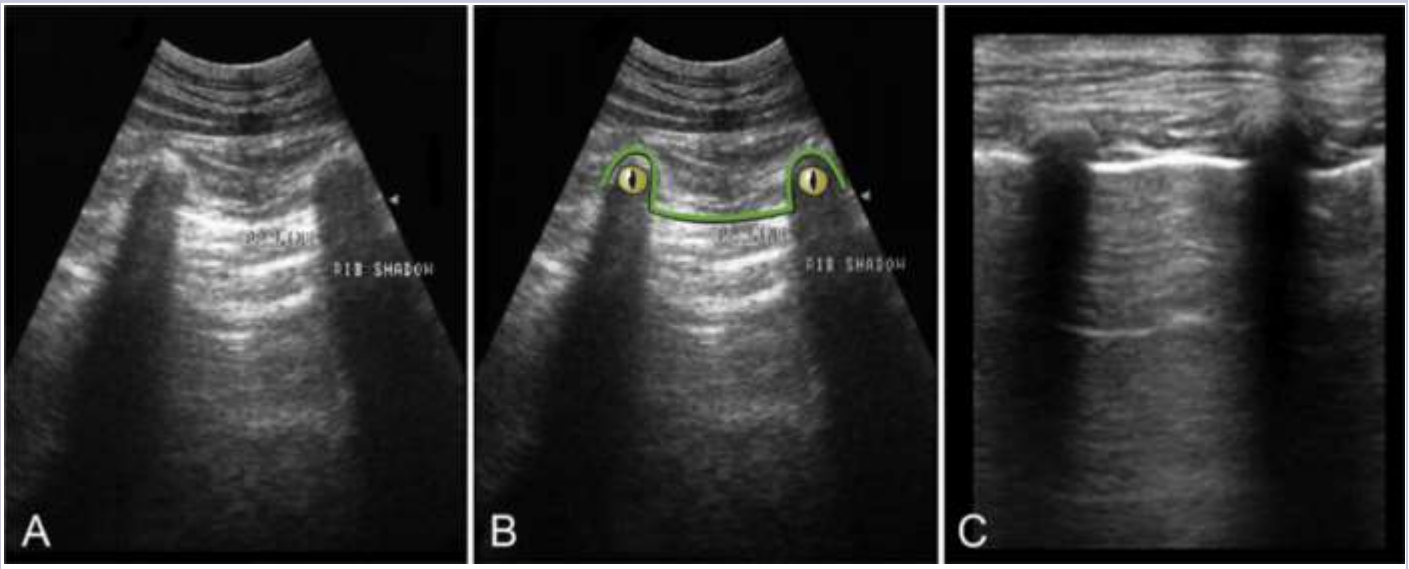
Patient Positioning

Vet BLUE is performed in sternal recumbency or standing and is safer for dogs and cats in respiratory distress. A roll of towels or paper towels under the forelegs of a cat is an easy, tolerated maneuver to gain access to the lower ventral Vet BLUE and TFAST pericardial site views. Vet BLUE may also be performed in dogs and cats in lateral recumbency.

Probe Orientation and Type

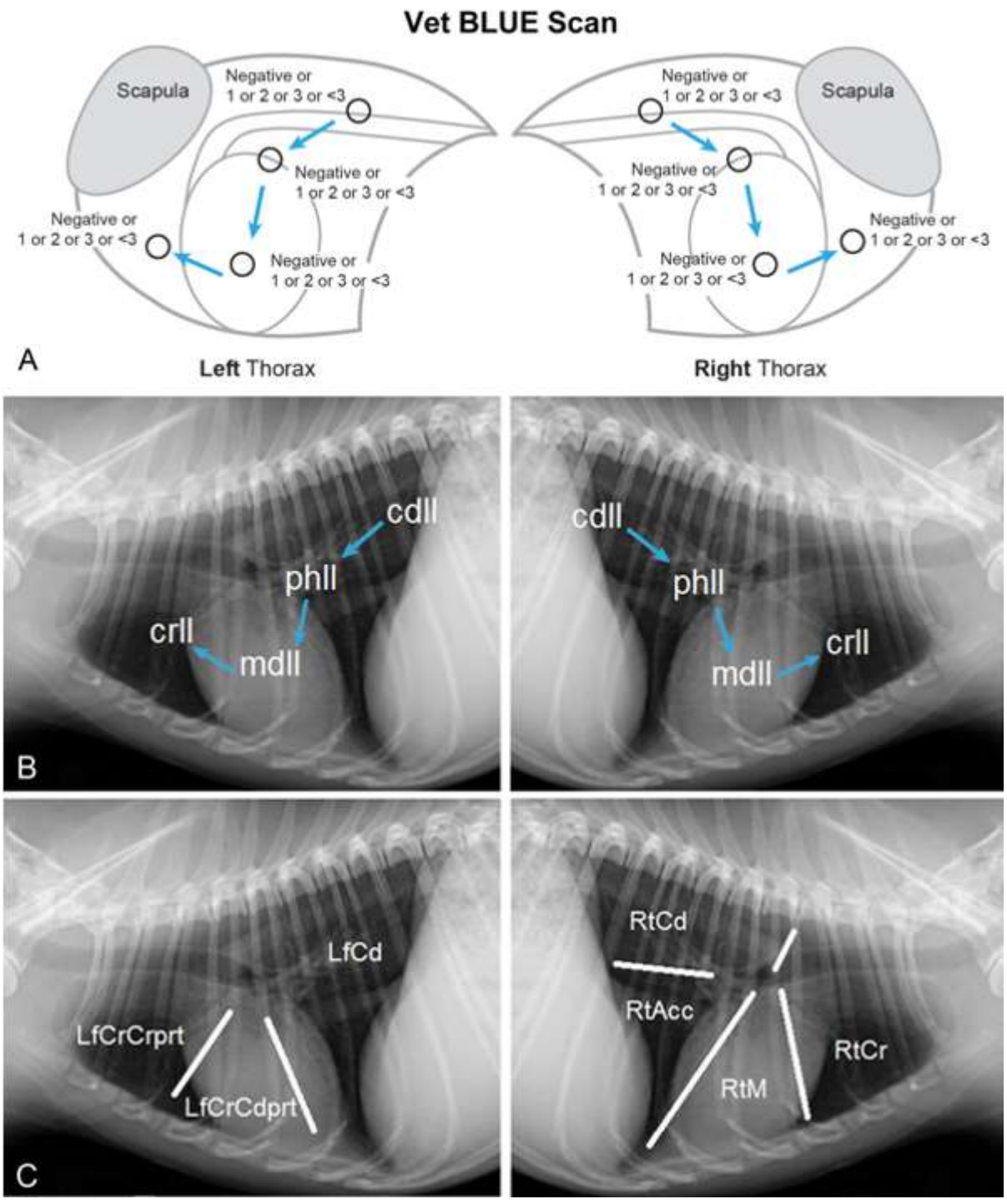
LUS orientation is always the same with the visualization of the "gator sign" to properly identify the pulmonary-pleural interface or the "lung line," actual surface of the lung. The probe is held perpendicular to the long-axis of the ribs; depth is generally set between 4 and 7 cm; frequency is generally set between 5–10 MHz; and a microconvex probe is preferred over a linear probe, because the probe is acceptable for all 3 formats - AFAST, TFAST and Vet BLUE - combined called Global FAST. A phase-array or sector probe is generally not recommended, because its focal point is too small, although this is unknown. A linear probe may be used; however, it is generally not ideal for the AFAST and TFAST portions of Global FAST.

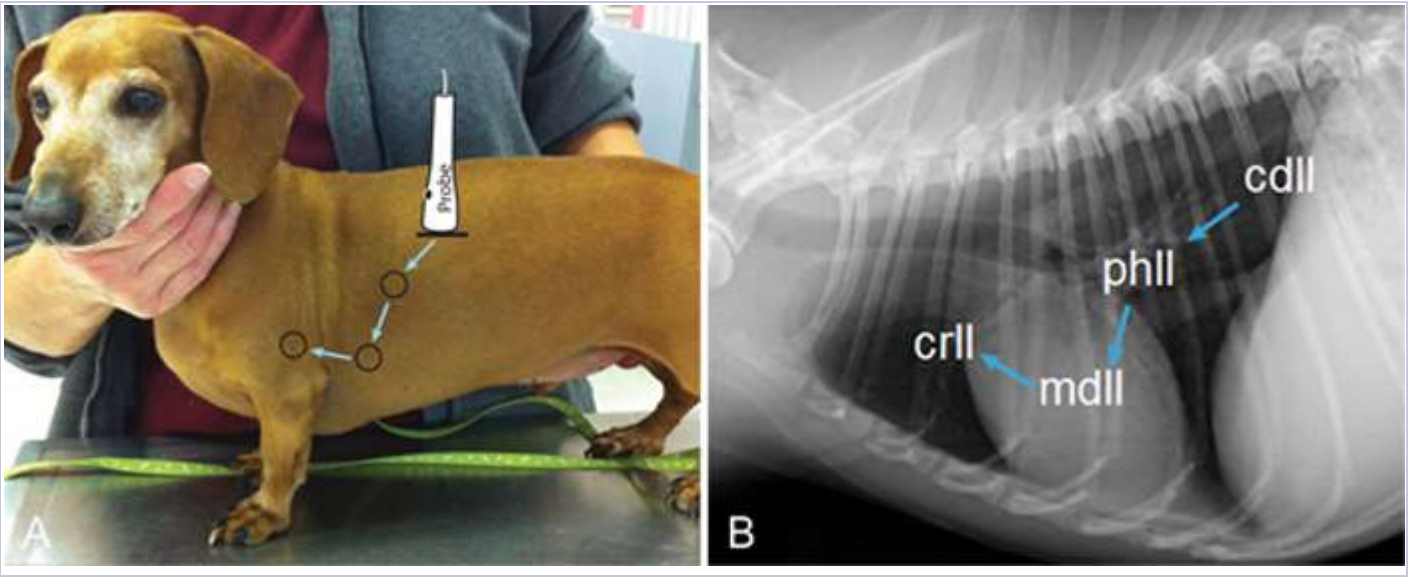
THE "GATOR SIGN" - BASIC LUNG ULTRASOUND ORIENTATION



The rounded rib heads are likened to the eyes, and the pulmonary-pleural (PP line) interface to the bridge of its nose, as a partially submerged gator (alligator) peers at the sonographer. The proximal white line is the focus of all LUS. This material is reproduced with permission of John Wiley & Sons, Inc., *Focused Ultrasound Techniques for the Small Animal Practitioner,* Wiley ©2014 and FASTVet.com ©2014.

How to Perform the Vet BLUE - 8 Acoustic Windows





How to Perform

The Vet BLUE lung examination is a screening test performed identically as the probe is positioned at the CTS view of TFAST. The probe is then moved through regional locations that are bilaterally applied as follows: caudodorsal lung region (Cd - same as the TFAST[3] CTS view, upper third, 8–9th intercostal space), perihilar lung region (Ph - 6–7th intercostal space, middle third), middle lung region (Md - 4–5th intercostal space, lower third), and cranial lung region (Cr - 2nd–3rd intercostal space, lower third).

Key Point

Best way to perform Vet BLUE accurately is to locate the left TFAST chest tube site directly above the xiphoid in the area of the 8–10th intercostal space in the upper 1/3rd of the thorax, find the transition zone where lung and abdomen interface, then by move 2 intercostal spaces cranially to make sure the probe is over lung/pleural space and not over liver/stomach/abdominal contents. From the left TFAST CTS, which is the same as the left Vet BLUE Cd view (point 1), draw a line with your alcohol or acoustic coupling gel to the elbow, and halfway to the elbow is the Vet BLUE Ph view (point 2), and near the elbow is the Vet BLUE Md view (point 3). If the heart is in view at the Vet BLUE Md view, slide above the heart until you see the lung line or in larger dogs you may slide caudally toward the diaphragm until the heart is lost and a lung line is seen. The final site is the Vet BLUE Cr view (point 4), which requires extending the foreleg cranially to get the probe placed in the 2nd–3rd intercostal space. Define the Cr view by finding its transition zone of the thoracic inlet and lung, then sliding caudally over intercostal spaces 1 and 2. If too ventral at the Cr view, you will see the striations of the pectoral muscles. The author's preference is to start high (dorsal) on the left, moving from Cd to Cr, and then do the same on the right hemithorax. By always performing in the same manner, findings are better remembered; and if you do not have the gator sign orientation, then you are not over lung.

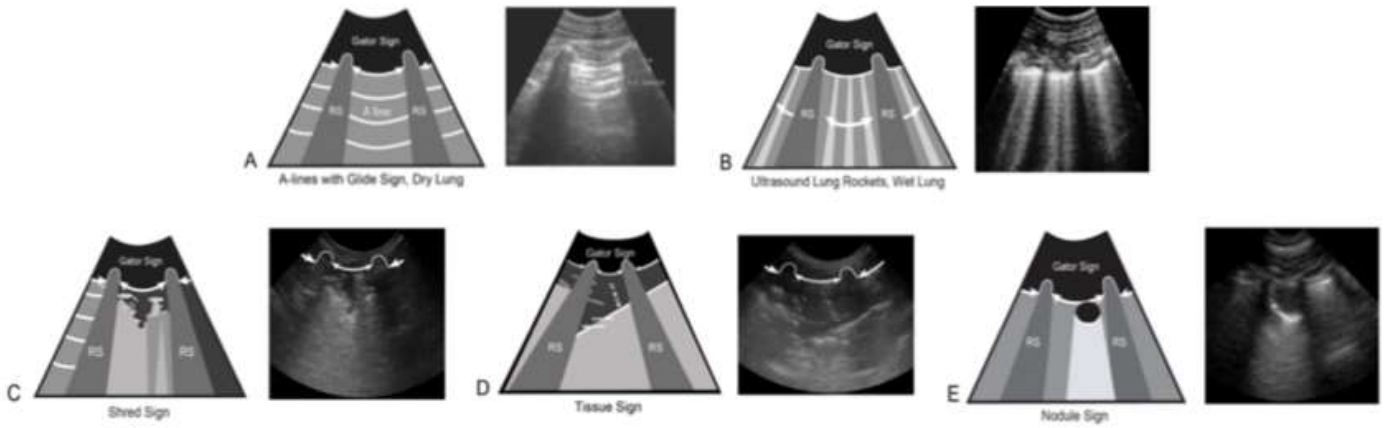
VET BLUE FOR RESPIRATORY DISTRESS - THE 5 BASIC LUNG ULTRASOUND SIGNS

Wet vs. Dry Lung - Basic Lung Ultrasound

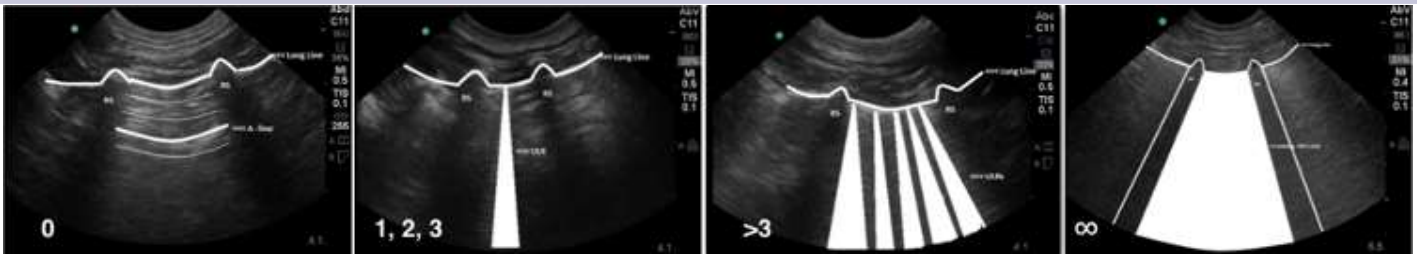
Basic easily recognizable LUS findings are categorized into the wet lung vs. dry lung concept. A glide sign with A-lines (reverberation artifact) at the lung line is considered "dry lung" only to be confounded with PTX (A-lines and no glide sign). However, many patients in which the probability of PTX is very low, then spending additional time finding the glide sign becomes less important and A-lines alone suffice. Ultrasound lung rockets (ULRs) are considered "wet lung" and oscillate to and fro with inspiration and expiration and must extend to the far field obliterating A-lines.

Shred Sign, Tissue Sign, and Nodule Sign (plus Wedge Sign) - Advanced Lung Ultrasound

These are the 3 more advanced LUS signs we have created in progressive order of increasing consolidation/infiltration. The shred sign is similar to an air bronchogram on TXR or rather consolidation with aeration of the lung; the tissue sign is similar to hepatization of lung or rather consolidation with**out** aeration; and the nodule sign or rather consolidation/infiltration in discreet nodules. The wedge sign is a subset of the shred sign and represents pulmonary thromboembolism (PTE) or rather infarcts at the lung periphery.



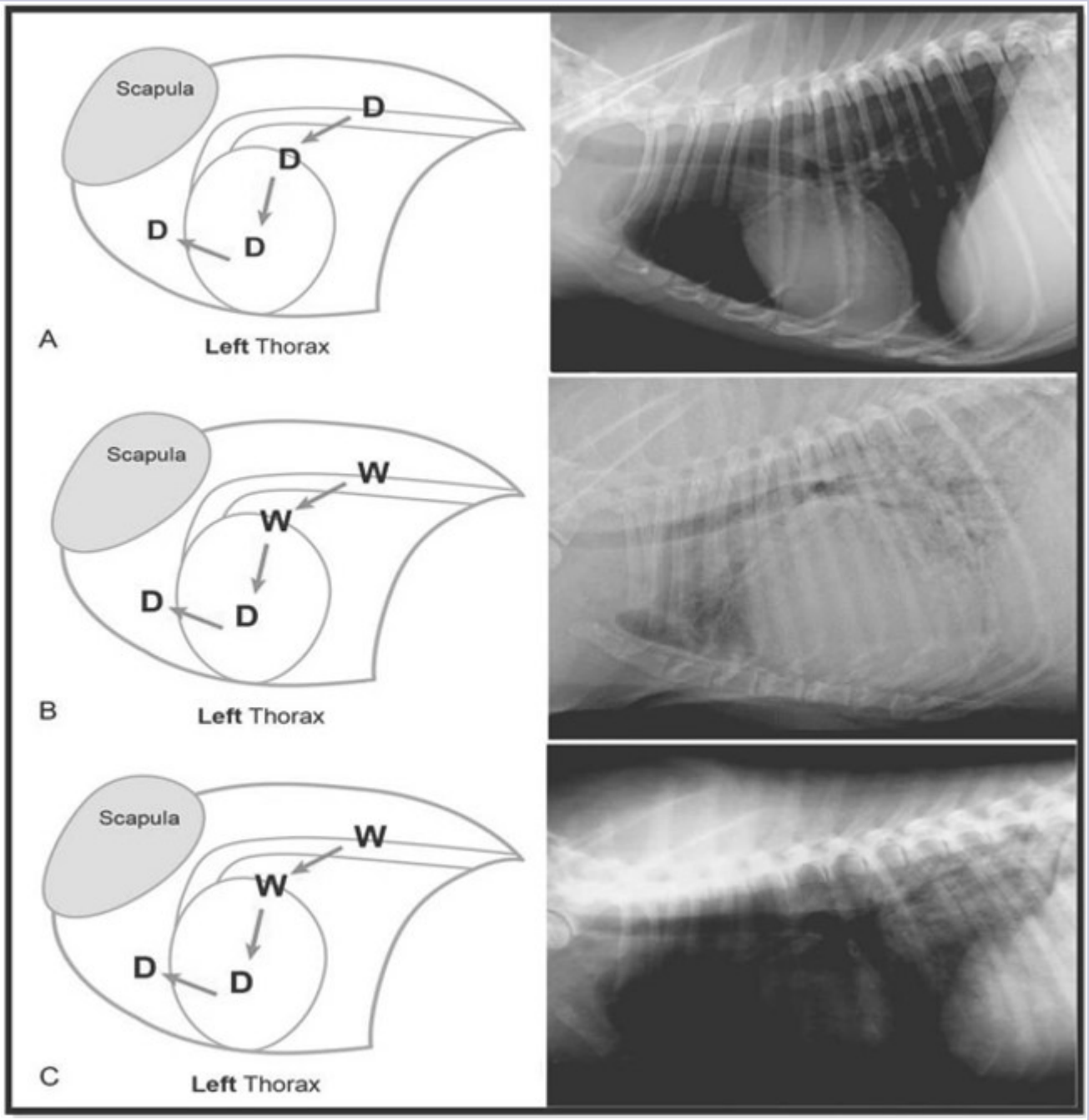
A) Dry lung; **B)** Wet lung, ULRS (alveolar-interstitial edema); **C)** Shred sign (air bronchogram); **D)** Tissue sign (consolidation with**out** aeration, hepatization) and **E)** Nodule sign. Wedge sign (PTE) is not shown. This material is reproduced with permission of John Wiley & Sons, Inc., *Focused Ultrasound Techniques for the Small Animal Practitioner,* Wiley ©2014 and FASTVet.com ©2014.



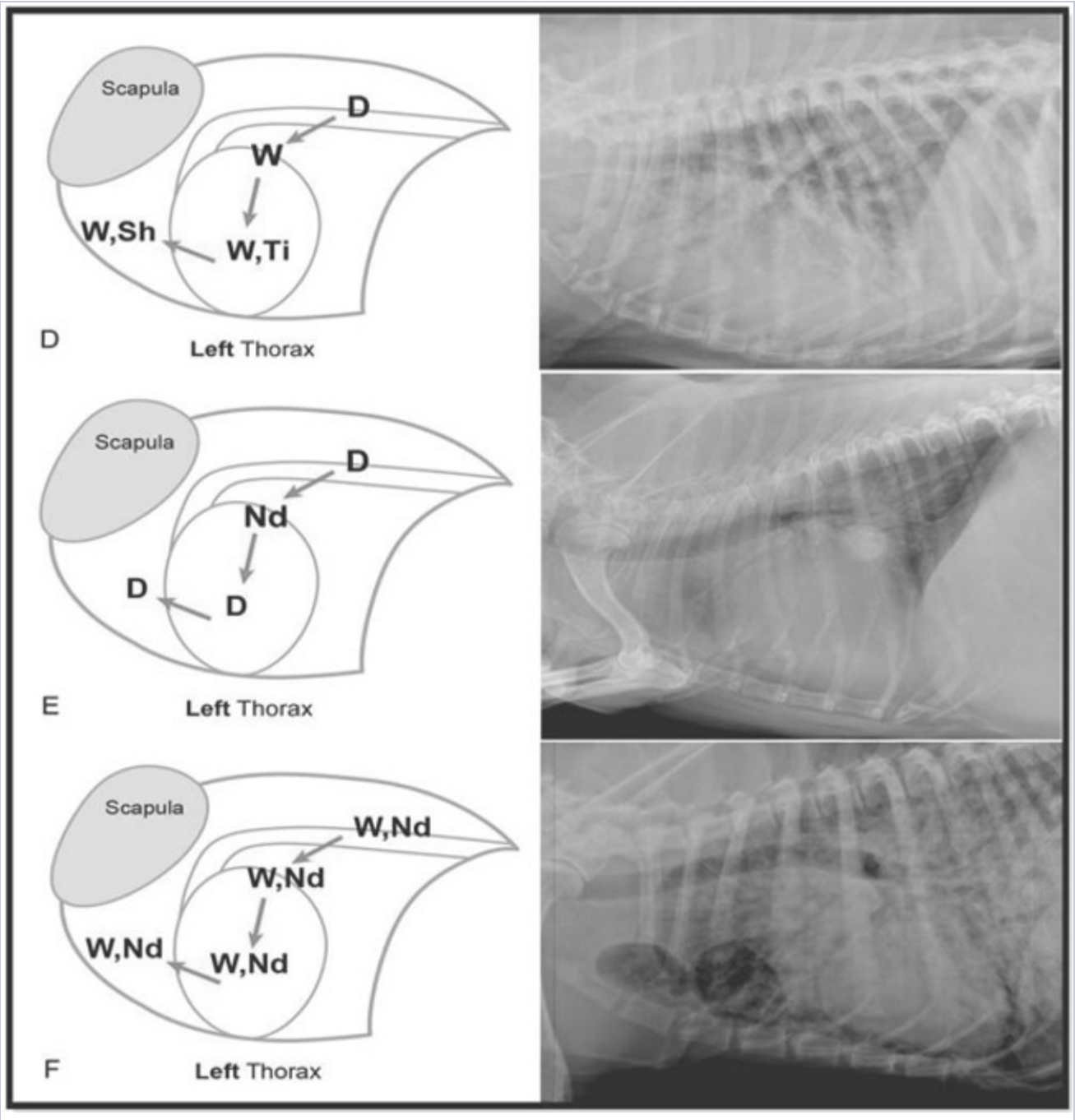
A) No ULRs; **B)** A single ULR scored as "1" or 2 or 3 not shown; **C)** >3 ULRs where there are more than 3, but ULRs are still recognized as individual ULRs; and **D)** ∞ or infinity ULRs. The maximum number of ULRs over a single representative intercostal space at each respective Vet BLUE view is recorded. The counting system is as follows: 0; 1; 2; 3; >3, when ULRs are still recognized as individuals; and ∞ or infinity, when the ULRs blend into one another, becoming confluent. FASTVet.com ©2015, 2016.

REGIONALLY BASED PATTERN APPROACH OF VET BLUE

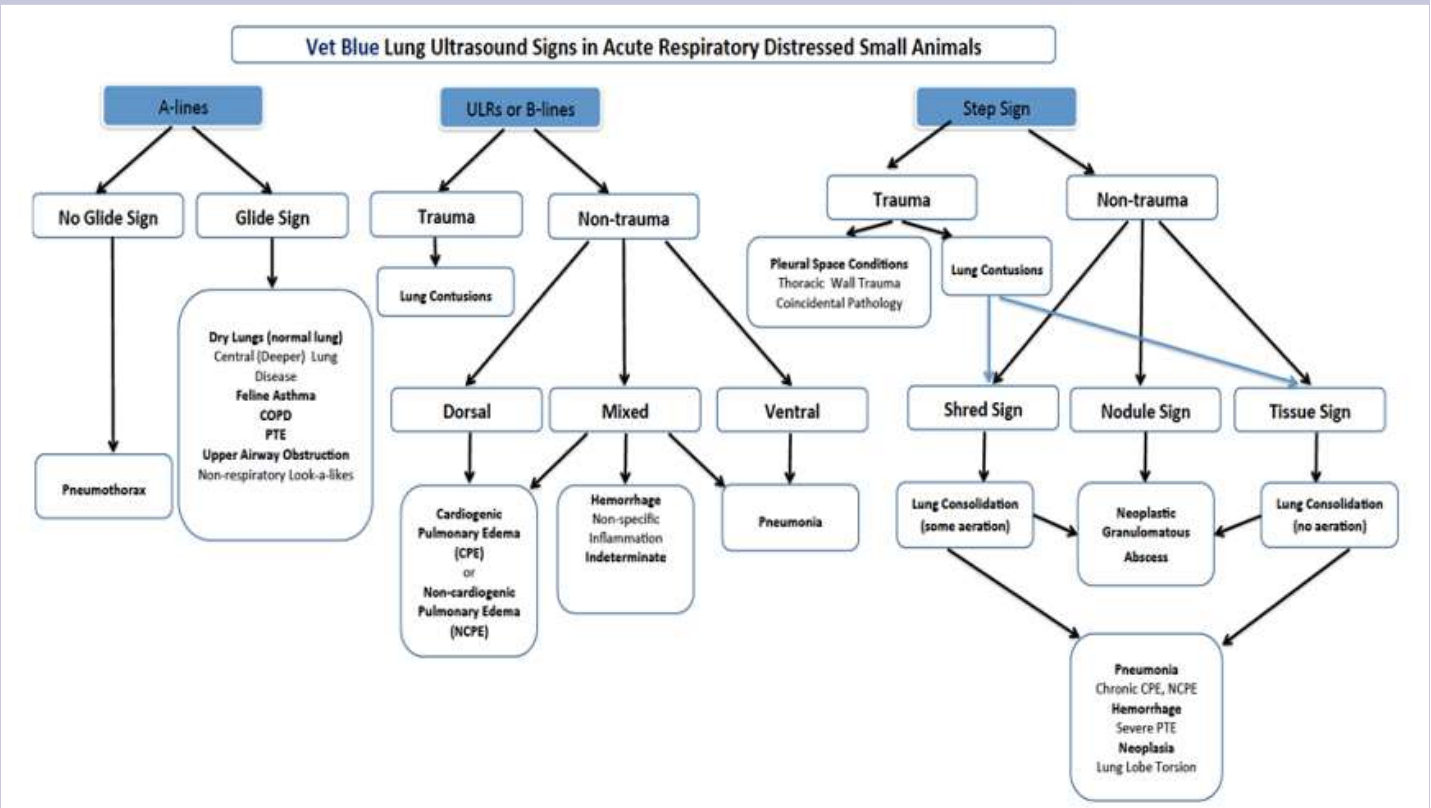
Clinical cases - examples of Vet BLUE regionally based patterns



A) Dry lung all fields rules out clinically relevant left-sided congestive heart failure, suggests upper airway obstruction, feline asthma, COPD, PTE and nonrespiratory lookalikes. **B)** Wet lung or ULRs in dorsal, perihilar, and middle lung regions suggests cardiogenic lung edema (left-sided congestive heart failure, volume overload from intravenous fluids). **C)** Wet lung in dorsal lung regions suggests forms of noncardiogenic lung edema. **D)** Wet lungs in ventral fields with or without signs of consolidation (shred sign/tissue sign), suggest pneumonia. **E)** Solitary nodule. **F)** Multiple nodules suggest metastatic disease or granulomatous disease. **Key:** D=Dry lung; W=Wet lung; Sh=Shred sign; Ti=Tissue sign; Nd=Nodule sign. Wedge sign (PTE) not shown.


Scapula
D
W
W,Sh
W,Ti
D
Left Thorax
Scapula
D
Nd
D
D
E
Left Thorax
Scapula
W,Nd
W,Nd
W,Nd
W,Nd
F
Left Thorax

VET BLUE DIAGNOSTIC ALGORITHM FOR FINDINGS AND PATTERNS



Rule Outs for DRY All Fields (or Absent B-lines All Views) on Vet BLUE Examination
RESPIRATORY
Pulmonary Thrombo-embolism (PTE)
Upper Airway Conditions (e.g., Collapsing Trachea, Laryngeal Paralysis), Obstruction (e.g., Mass)
Chronic Obstructive Pulmonary Disease (COPD), Feline Asthma
Centrally located lung pathology away from the lung line (missed by Vet BLUE)
CARDIAC
Cardiac Tamponade, Cardiac Arrhythmia, Dilated Cardiomyopathy (DCM), Right-sided CHF
UNDIFFERENTIATED HYPOTENSION
Anaphylaxis
Hemoabdomen, Hemothorax, Hemoretroperitoneum, other cavitary or hemorrhage in a space
Gastric-Dilatation-Volvulus (GDV)
Septic Abdomen
OTHER NON-RESPIRATORY
Pyrexia or High Fever
Severe Metabolic Acidosis
Severe Anemia
NOTE: Dry Lungs ALL Fields is a Rapid (<90 seconds) Highly Sensitive Test Ruling Out Left-sided CHF (Dogs 88%, Cats 96%)
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SPEAKER INFORMATION

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