

Thoracic FAST (TFAST®) for Trauma, Triage, and Tracking

SOUTHWEST VETERINARY SYMPOSIUM 2017

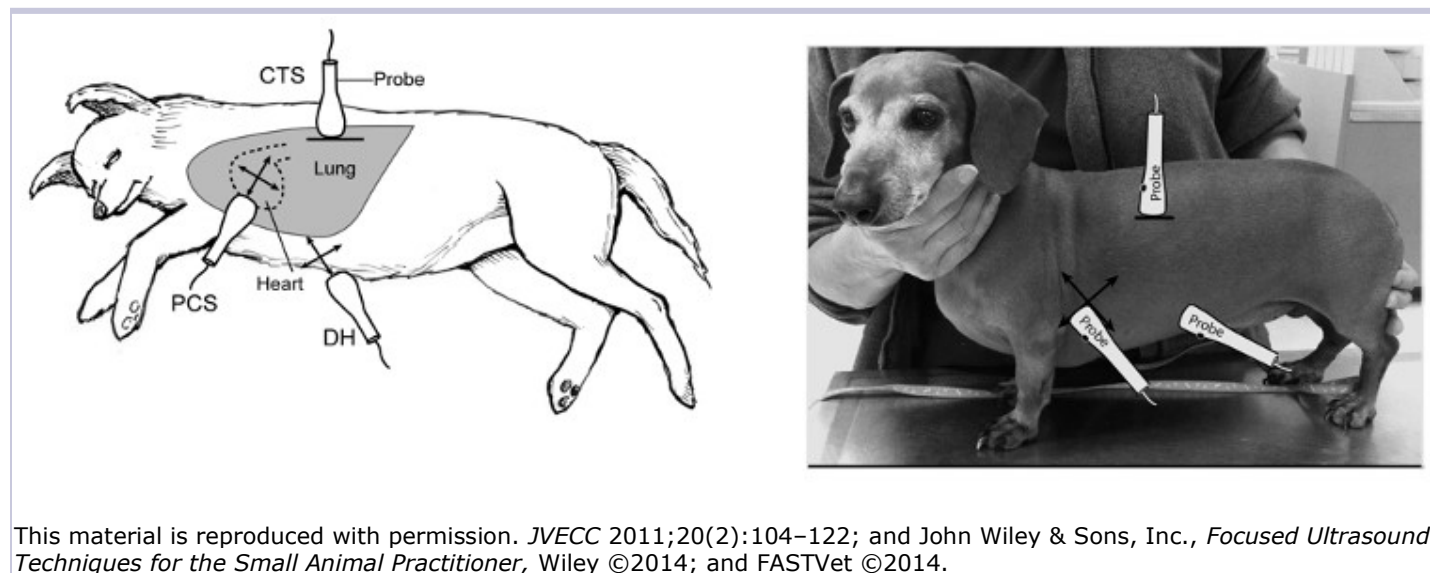
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INTRODUCTION, TERMINOLOGY, PATIENT POSITIONING, AND PREPARATION

See [AFAST Proceedings](#).

THE TFAST EXAM

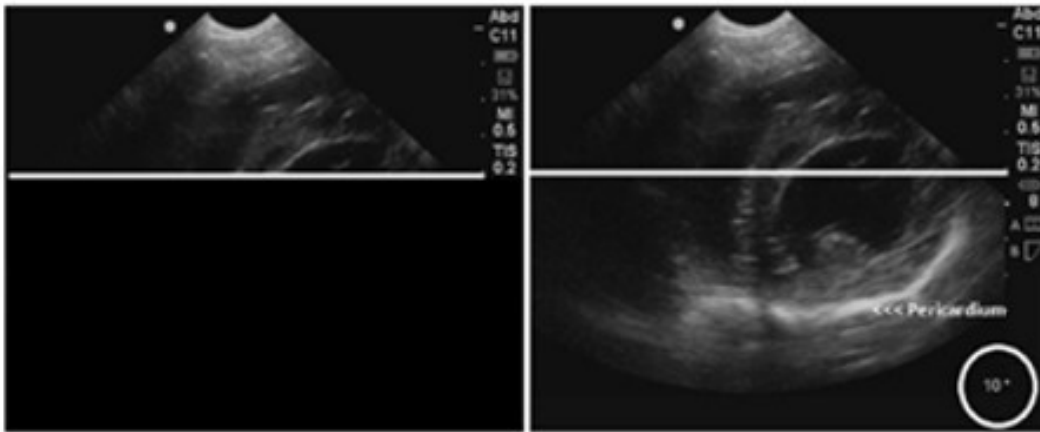


STRENGTHS AND WEAKNESSES OF THE TFAST VIEWS

The bilaterally applied **CTS view** is best used to rule out pneumothorax (PTX) and survey for lung pathology (see [Vet BLUE Proceedings](#)). The CTS view is the highest reasonable point on the thoracic wall where the cap of air would rise in the event that PTX was present. Thus, if lung is observed against the thoracic wall then PTX is ruled out. In the event that PTX is suspected then search for the "lung point" to determine the degree of PTX (see below). The bilaterally applied **PCS view** is best used to screen for the presence of pleural or pericardial fluid; and is used for volume status and contractility assessment via the left ventricular short-axis "mushroom" view (LVSA), for the "quick peek" left atrial to aortic ratio (LA:Ao) to screen for left-sided cardiac conditions, and the 4-chamber long-axis view for right-sided conditions (RV:LV). However, non-echo views may be used in place of the echo views when the patient won't allow or restraint for echo views is too risky through use of the Vet BLUE lung scan and characterization of the caudal vena cava at the FAST DH view for left- and right-sided cardiac conditions, respectively (see Vet BLUE and Global FAST Proceedings). The single **DH view** may be superior for the detection of pericardial and pleural effusion fluid over transthoracic TFAST³ views because of the acoustic window provided by the liver and gallbladder and less air interference from the lung at the TFAST³ PCS views. Our strategy taught to non-radiologist, non-cardiologist veterinarians is to image toward the solid muscular apex of the heart where a heart chamber is unlikely to be misinterpreted for pleural or pericardial effusion. The finding has been described and referred to as the "racetrack sign" and "bull's eye sign" by the author in *Focused Ultrasound Techniques for the Small Animal Practitioner*. By imaging toward the muscular apex of the heart, using multiple views by combining the DH view and TFAST³ PCS sites, and abiding by the sage axiom "1 view is no view," the probability of misinterpreting a fluid-filled heart chamber for pericardial and pleural effusions is lessened.

THE DIAGNOSIS OF PERICARDIAL VS. PLEURAL EFFUSION

When performing the TFAST left and right pericardial views, make it a habit to have enough depth to see the heart globally or, in other words, in its entirety. Your landmark is the bright white hyperechoic pericardium in the far-field. The sonographer should be aware that too shallow of depth easily leads to the possibility of mistaking heart chambers for pleural and/or pericardial effusion, especially in distressed patients that provide only quick glimpses of the heart due to air interference from lung. The concept is illustrated in the images below.

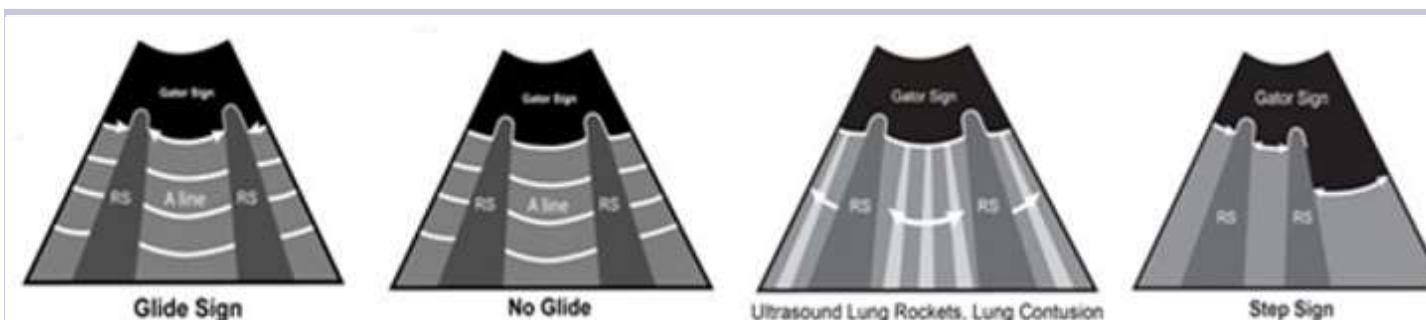


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Diagnosis of Pericardial Effusion The Gold Standard for the Diagnosis of Pericardial Effusion is Ultrasound Radiography is Poor Pericardial Effusion is Contained in the Pericardial Sac that Attaches at One Atrium and Rounds the Apex of the Heart to Attach to the Other Atrium		
Imaging Strategy	FAST DH View	TFAST PCS View
*Image toward the muscular apex of the heart where no heart chambers can be mistaken for free fluid	*FAST DH View – Racetrack Sign	*TFAST Right PCS View – Bull’s Eye Sign
*Long-axis 4-chamber view where all 4 chambers are identified		*TFAST Right PCS View
*Image the heart globally in its entirety using the bright white pericardium in the far filed as a landmark		
Diagnosis of Pleural Effusion The Gold Standard for the Diagnosis of Pleural Effusion is Debatably Computerized Tomography Radiography is Generally Good Pleural Effusion is Uncontained and Unrestrained Unless Compartmentalized		
Imaging Strategy	FAST DH View	TFAST PCS View
*Image the heart globally in its entirety using the bright white pericardium in the far filed as a landmark		*TFAST Right and Left PCS – Anechoic (Black) Triangulations
*Image toward the muscular apex of the heart where no heart chambers can be mistaken for free fluid	*FAST DH View – Anechoic (Black) Triangulations	

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TFAST FOR PNEUMOTHORAX, LUNG CONTUSIONS, AND THORACIC WALL TRAUMA



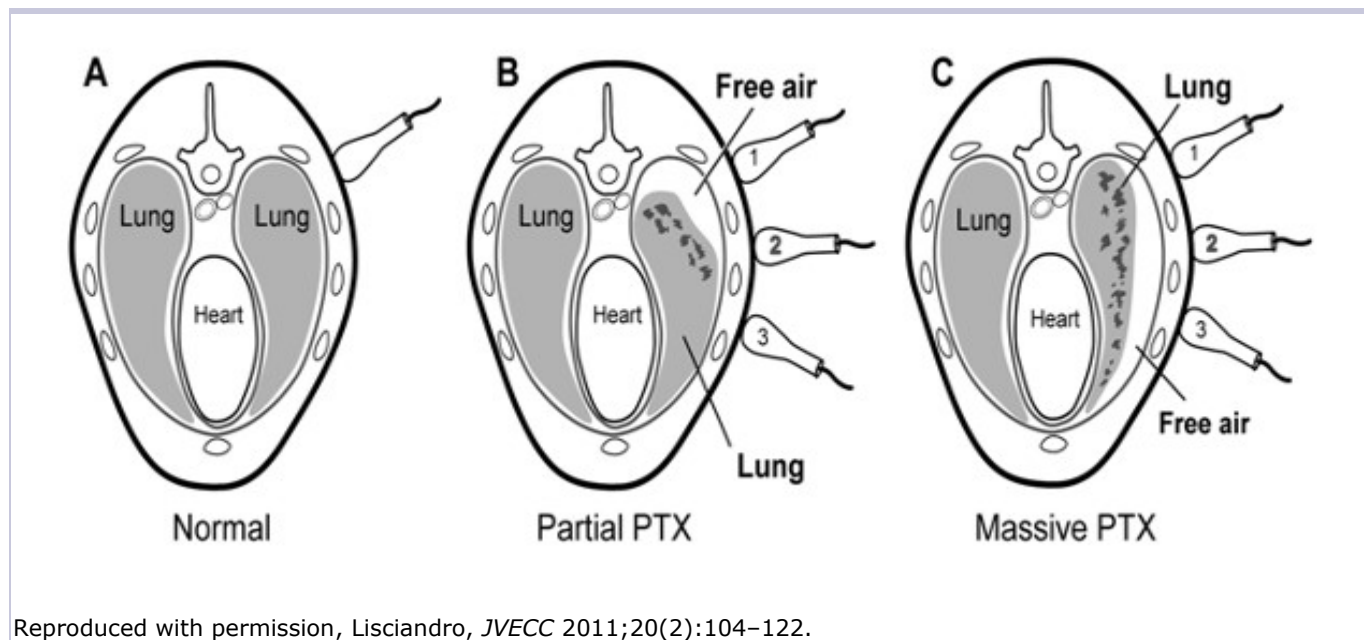
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Basic Lung Ultrasound Findings at the Chest Tube Site (CTS) View - Glide Sign, Pneumothorax (PTX), Lung Rockets, and Step Sign

The illustrations depict in order from left to right, 1) normal dry lung (A-lines with the Glide Sign); 2) pneumothorax (PTX) (A-lines without the Glide Sign); 3) ultrasound lung rockets (ULRs) are also called B-lines and are defined as hyperechoic laser-like streaks that do not fade extending to the far-field obliterating A-lines and oscillating in synchronization with inspiration and expiration. In trauma, ULRs represent lung contusions until proven otherwise; and by counting the number of ULRs at each intercostal space, semi-quantification of severity of lung contusions may be made (see Vet BLUE); 4) Step sign representing deviation from the expected linear to and fro movement of the pulmonary-pleural interface suggesting thoracic wall

trauma, i.e., intercostal tear(s), fractured rib(s), subpleural hematoma; and/or pleural space conditions, i.e., effusions, diaphragmatic hernia, masses. However, in nontrauma there are subsets of the step sign referred to as the shred sign, wedge sign (PTE), tissue sign, and nodule sign that represent forms of lung consolidation/infiltration (see Vet BLUE). These lung ultrasound signs are well described in the textbook *Focused Ultrasound Techniques for the Small Animal Practitioner* ©Wiley 2014. Both the presence of the glide sign and ULRs immediately rule out PTX at that point on the thorax because neither is present when air in the pleural space separates the lung from the thoracic wall. Importantly all lung sonographers should be aware of the limitations of lung ultrasound. Because ultrasound does not transmit through air, deeper and more centrally located lung pathology that does not touch the lung surface will be missed. Thus, Vet BLUE does not replace the need for thoracic radiography or other advanced imaging once the patient is stable or when radiology becomes available.

Use of TFAST for the "Lung Point" - The Degree of PTX



Cross-sectional of the canine thorax in sternal recumbency, depicting the quantification of the degree of pneumothorax (PTX) as partial or massive by searching for the "lung point" defined as the level at which lung re-contacts the thoracic wall. The author records as upper 3rd (trivial), middle third moderate and concerning, and lower 3rd severe; and uses this system for deciding on thoracocentesis and progressing, static or resolving PTX.

CLINICAL INDICATIONS/APPLICATIONS FOR TFAST

The use of TFAST³ should be simply stated as an "extension of the physical exam" for all dogs and cats that are abnormal or suspect. Questionable findings within the thorax using the FAST DH view should be confirmed via TFAST³ PCS view(s) or Vet BLUE or both and by serial exams by repeating TFAST³ and Vet BLUE at least once 4 hours later. Global FAST should be adopted as a first-line screening test, just as we have been trained to perform basic blood tests. Global FAST carries the potential to detect many effusive and soft tissue conditions of the abdomen, heart, and lung missed by radiography. Indications include but are not limited to: 1) blunt trauma; 2) penetrating trauma; 3) collapse, apparent collapse; 4) undifferentiated hypotension; 5) anemia; 6) acutely decompensated cardiac case, detection of left atrial tears; 7) respiratory distress (since there are nonrespiratory lookalikes [hemoabdomen, cardiac tamponade, anaphylaxis, high fever, and others]); 8) post-interventional at-risk bleeding (surgery, percutaneous procedures [lung lobe aspirates]); 9) thoracoscopy, chest tube; 10) post-interventional at-risk pneumothorax (surgery, percutaneous procedures [lung aspirates, tracheal

wash], thoracoscopy, chest tube); 11) monitoring PTX, pleural and pericardial effusions; 12) detecting and monitoring cardiogenic and noncardiogenic pulmonary edema (Vet BLUE better); 13) patient monitoring during fluid resuscitation and during hospitalized care; and 14) preanesthetic screening test.

Goal-Directed Templates For TFAST

*Right and left sides are listed in templates for the CTS and PCS views

*CTS glide sign:	Present (normal) – no Pneumothorax or Absent – Pneumothorax or Indeterminate
*CTS lung rockets:	Present (no PTX) – interstitial lung fluid (edema, hemorrhage) or Absent – no interstitial lung fluid or Indeterminate
*CTS step sign:	Present – concurrent thoracic wall trauma (rib fractures, hematoma, intercostal muscle tear) or pleural space disease is suspected or Absent - no concurrent thoracic wall trauma or pleural space disease is suspected or Indeterminate
*PCS view:	Absent - no pleural or pericardial fluid or Present - pleural or pericardial fluid or both (mild, moderate, or severe) or Indeterminate
LV filling (short-axis):	Adequate suggesting normovolemia or inadequate suggesting hypovolemia or Indeterminate
DH View:	Pleural effusion: absent, present (mild, moderate, severe) or indeterminate Pericardial effusion: absent, present (mild, moderate, severe) or indeterminate Hepatic venous distension: present, absent or indeterminate Caudal vena cava characterization: FAT, flat or bounce or indeterminate
Cardiac tamponade:	Present or Absent or Indeterminate

Comments: _____

KEY: CTS = chest tube site; PCS = pericardial sac; LV = left ventricle, PTX = pneumothorax

Note: The TFAST³ exam is a rapid ultrasound procedure used to help detect major chest wall, lung, and pleural and pericardial space problems as a screening test in order to better direct resuscitation efforts or manage hospitalized critical patients. TFAST³ exam is not intended to replace thoracic radiographs, or complete echocardiography.

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SPEAKER INFORMATION

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