

TFAST® for the Accurate Diagnosis of Pleural and Pericardial Effusion and Its Echo Views

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Introduction

The clinical utility of TFAST®, its use for the rapid detection of pneumothorax, pleural and pericardial effusion, and its target-organ approach for the heart, will be reviewed. The previously published T³ designation was meant to include Trauma, Triage (non-trauma), and Tracking (monitoring) to avoid the confusing acronyms in human and now veterinary medicine, in which similar FAST ultrasound examinations are given different acronyms and names for different subsets of patients. However, TFAST®, as with Global FAST®, is best now considered as "an extension of the physical examination" and the T³ designation is unnecessary as more and more veterinarians understand its widespread applications. Moreover, TFAST® is standardized and has *exact* clarity to its 5-acoustic windows or views (Lisciandro et al. 2009; Lisciandro 2011, 2014, 2016, 2020; Boysen and Lisciandro 2013; McMurray et al. 2016).

The TFAST® examination carries greater potential to positively guide clinical course and improve patient outcome by detecting conditions and complications otherwise missed or delayed based on traditional first line evaluations of physical examination, laboratory testing, and radiographic finding. TFAST® findings are made more clinically relevant for the clinician, client, and referring veterinarian by using its standardized format, and by recording TFAST® findings on standardized goal-directed templates for medical records (see below).

The mindset for those using TFAST® is one of a *ruling in* and *ruling out* test (highly specific and highly sensitive) for pleural or pericardial effusion, and for pneumothorax. TFAST® also serves as a *ruling in* test for soft tissue abnormalities of its target-organ, the heart (specific but variably sensitive), meaning if you see an abnormality, it's likely real, however, if you don't see an abnormality, then it may have been missed, being user dependent. Importantly, the TFAST® does not replace complete detailed echocardiography. By using our approach as an "extension of the physical exam", TFAST® serves as a means to better survey veterinary patients, and to better keep alive for gold standard testing and treatment.

The standardization and clarity of Global FAST®, the term used for combining AFAST®, TFAST® and Vet BLUE®, is the author's recommended approach for using point-of-care ultrasound (POCUS) because it avoids "selective imaging" and "satisfaction of search error." "Selective imaging" leads to confirmation bias, searching for evidence to fulfill the clinician's preconceived bias for the diagnosis. "Satisfaction of search error" is common in radiology and occurs when the evaluator stops at the first abnormality carrying the potential to miss other important findings. Advantageously, the Global FAST® Approach provides exact clarity to an unbiased set of 15 data imaging points of the abdomen and thorax, including heart and lung (Lisciandro 2011, 2012, 2014, 2020); and should preempt all other POCUS examinations. *The bottom line, POCUS examinations should be considered as an add-on to Global FAST®, or the 2 approaches should be used together to avoid such errors.* The Global FAST® Approach is our 3rd standardized veterinary ultrasound examination, in addition to complete detailed abdominal ultrasound and complete echocardiography, and should be used as a first line extension of the physical exam in most if not all patients (Lisciandro 2020).

Distinguishing Global FAST® from Flashing and POCUS

Global FAST®. Global FAST® is the combination of AFAST® and its Target-organ Approach, and its Abdominal Fluid Scoring System, TFAST® for the detection of pleural and pericardial effusion, pneumothorax, and its 4 TFAST® echo views, and Vet BLUE®, the veterinary brief lung ultrasound exam, a regional, pattern-based approach with its B-line Scoring System, and its Visual Lung Language. Each of these 3 ultrasound formats has exact clarity to its respective acoustic windows (views) and findings (patient data) are recorded in goal-directed templates. Without this disciplined approach, accurate tracking patients and measuring overall program quality is impossible. Moreover, the veterinary radiologist and cardiologist perform their studies in the exact same manner every time for good reasons, to better know where to expect anatomy, and better recognize deviations from what is expected, and to not miss abnormalities.

Flash exams. The "Flash Approach" is a term applied to a desultory sweep (no organized direction, no defined acoustic windows, no clarity) of the abdomen, thorax, and now lung answering a simple binary question of fluid positive or fluid negative within the abdomen and thorax; and the presence or absence of B-lines (also called lung rockets). The "Flash mentality" should be likened to performing an incomplete physical examination and for most veterinarians we know the risk of missing important clinical information by doing so.

Point-of-care Ultrasound (POCUS). Point-of-care ultrasound (POCUS), which includes FAST (focused assessment with sonography for trauma, triage and tracking) examinations, is defined by the author as a goal-directed ultrasound examination(s) performed by a healthcare provider point-of-care (cageside) to answer a specific diagnostic question(s) or guide performance of an invasive procedure(s).

The Global FAST® Approach is not a "Flash exam." AFAST®, TFAST®, Vet BLUE®, and Global FAST® should never be used interchangeably with the "Flash approach." These terms have been and continue to be erroneously and misleadingly used by some of our colleagues.

The Global FAST® Approach should be used as a baseline set of unbiased data imaging points surveying both cavities and then POCUS or Focused Exams as add-on evaluations to prevent "selective imaging", "satisfaction of search error", and for increasing the probability of an accurate assessment through integration of clinical findings.

Patient Positioning, Preparation, Probe Type, Preset, Probe Maneuver

Positioning. Standing (sternal) and lateral recumbency are used. Right lateral recumbency is preferred over left lateral because of it is advantageous for echocardiography, electrocardiography, and imaging the caudal vena cava, however, the fluid scoring system is validated in either lateral positioning. Generally, if a patient is standing, TFAST® and Vet BLUE® are first performed from the left side followed by AFAST® and a Focused Spleen after which a right Vet BLUE®, TFAST® echo views and the HR5th Bonus view of AFAST® are performed on the patient's right side. The format is called the Global FAST® blend and is low impact for the patient requiring minimal restraint and patient risk if hemodynamically fragile.

Regarding AFAST®, if the patient is AFAST®-negative in standing (or sternal), then lateral recumbency is unnecessary. If the patient is AFAST®-positive, then follow the "AFAST® 3-minute fluid scoring rule" of moving to lateral recumbency and waiting 3-minutes to allow free fluid to redistribute for an accurate abdominal fluid score. Right lateral recumbency is generally only added to a standing AFAST®- Global FAST® when TFAST® echo views and characterization of the caudal vena cava and its associated hepatic veins are unsatisfactory, or

changes in positioning are warranted to better interrogate target-organs. *Dorsal recumbency is never used because it is too risky for hemodynamically fragile or unstable patients especially with intrathoracic problems including cardiac and pulmonary conditions and pleural space disease.*

Preparation. Fur is not shaved but rather parted with minimal amounts of isopropyl alcohol followed by alcohol-based hand sanitizer because it couples as well as commercially available gel with the advantage of evaporating off the patient. Alcohol-based hand sanitizer is also less noxious and less cooling than isopropyl alcohol; and less goeey (hand sanitizer evaporates) than acoustic coupling gel. Isopropyl alcohol should not be used if electrical defibrillation is anticipated (fire/burn hazard).

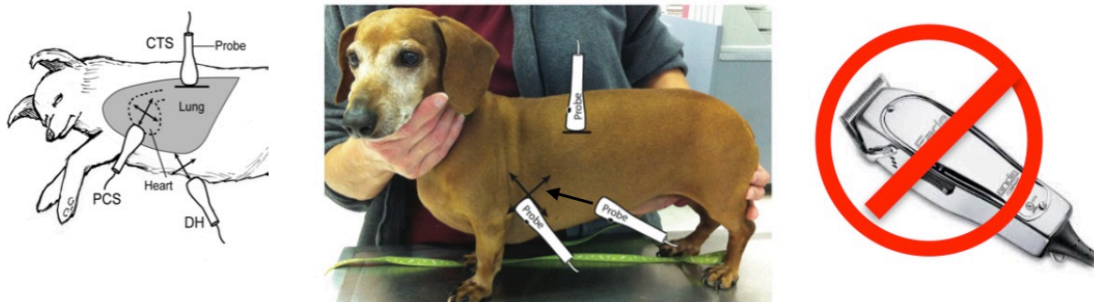
Make every attempt to part the fur and place the probe as directly as possible on skin to maximize the image quality and minimize "air-trapping" between the probe head and the skin.

Probe Type. The microconvex curvilinear probe is used for the entire Global FAST®. A phased-array (sector) cardiac probe and linear probe may be used but each are unnecessary, only adding more time to the examination, and are generally reserved for more complete detailed examinations.

Preset. The TFAST® and entire Global FAST® are performed with the abdominal preset. Changing the preset is unnecessary and only adds time, reserved for more complete detailed examinations.

Probe Maneuver. The probe maneuvering is standardized for lung and cardiac views. Lung begins with the Gator Sign orientation and maintaining longitudinal planes. The left Pericardial Site View has the TFAST slide cranial and caudal to the heart into pouches named the cardiac-diaphragmatic and cardiac-cervical pouch, respectively.

The TFAST®



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Strengths and Weaknesses of the TFAST® Views

There are 5 acoustic windows for TFAST®. These are the bilaterally-applied Chest Tube Site and Pericardial Site views, and the singly-applied Diaphragmatico-Hepatic view. As an aside, the CTS site view followed by Vet BLUE are performed first, followed by the Pericardial Site views on both the left and right side.

Pneumothorax - Chest Tube Site (CTS) views. The bilaterally-applied CTS view is best used to rule out pneumothorax (PTX) and survey for lung pathology (see Vet BLUE Proceedings) on both the left and right

sides. The CTS view is along the highest accessible locations on the thoracic wall where the free air within the pleural cavity would rise to in the presence of PTX. Thus, if lung is observed in direct opposition to the thoracic wall at the CTS view, most commonly by "lung sliding" or B-lines, then PTX is ruled out. When PTX is suspected, then search for the "Lung Point" to determine the degree of PTX (see below).

Pleural and Pericardial Effusion, Echo Views - Pericardial Site (PCS) views. The bilaterally-applied PeriCardial Site (PCS) views on both the left and right sides are used to screen for the presence of pleural and pericardial effusion; and the right side for TFAST echo views including for volume status and contractility assessment via the left ventricular short-axis "mushroom" view (LVSA), for the "quick peek" short-axis left atrial to aortic ratio (LA:Ao) to screen for left-sided cardiac problems (increased left atrial filling pressure), and for the long-axis 4-chamber view to screen for right-sided conditions (RV:LV) (increased right ventricular filling pressures); and the long-axis 4-chamber view with the left ventricular outflow tract (LVOT) for abnormalities within the LVOT and its aorta.

The TFAST[®] Echo Views and The Global FAST[®] Fallback View Strategies

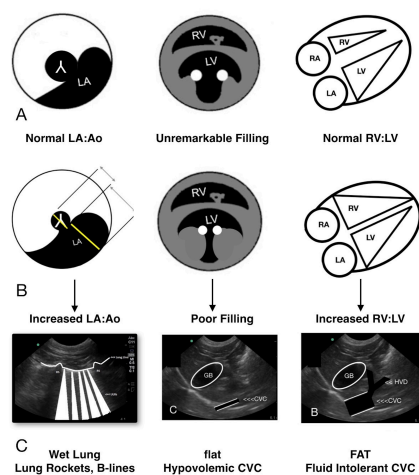


Figure. Integrating TFAST[®] Echo View Findings with the Global FAST[®] Non-echo Fallback Views. The short-axis left atrial (LA) to aortic (Ao) ratio (LA:Ao) is assessed at the heart base with the "Global[®] FAST Non-echo Fallback View" of Vet BLUE[®] and its wet lung versus dry lung principle (see Vet BLUE[®] Proceedings). The left ventricular short-axis view (LVSA) so called "mushroom" view in A) is assessed for volume and contractility (fractional shortening, FS%) with the "Global FAST[®] Non-echo Fallback View" of the FAST DH View for caudal vena cava and hepatic venous characterization. The long-axis 4-chamber view (LA4C) is assessed for right-sided strain/failure/overload by evaluating the right ventricular (RV) to left ventricular (LV) ratio (RV:LV) with the "Global FAST[®] Non-echo Fallback view" of caudal vena cava and hepatic venous characterization. See text for more detailed explanation.

Global FAST[®] Non-echo Fallback Views

"Global FAST[®] Non-echo Fallback Views" are hugely impactful for 2 major reasons. **First**, when performing the TFAST[®] echo views, suspect problems may be double-checked with fallback views. For example, the sonographer thinks that the LA:Ao is increased, then uses Vet BLUE and finds that the lung is dry (absent B-lines), no evidence of left-sided congestive heart failure, concluding that the case may have left-sided disease, but has no evidence of left-sided congestive heart failure. Conversely, if Vet BLUE shows wet lung, and its regional, pattern-based approach supports left-sided congestive heart failure (versus pneumonia), then there

is an urgency to continue the work-up and treat the patient. The same logic holds for an increased RV:LV, however, the caudal vena cava and its associated hepatic veins are used for assessment, because right-sided congestive heart failure results in hepatic venous congestion and thus at the DH view, a distend caudal vena cava and its associated hepatic veins (Tree Trunk Sign). As for poor volume, the caudal vena cava is also assessed and a flat (small maximum height) cava supports more severe depletion than a caudal vena cava with a bounce. And Vet BLUE and the DH View should always be used in tandem to assess for left- and right-sided congestive heart failure to better assess and treat and monitor the patient. As for poor contractility, Vet BLUE and the DH view are used to screen for concurrent left- and right-sided failure. **Second**, the "Global FAST® Non-echo Fallback Views" are used when it's too risky for TFAST echo views because of patient status, or because they are difficult to image. Dry lung, or absent B-lines on Vet BLUE, rules out left-sided congestive heart failure; and a "bounce" to the caudal vena cava along with an absence of hepatic venous distension (no Tree Trunk Sign), rules out right-sided congestive heart failure (Lisciandro et al. VRUS 2014, JVECC 2016, 2017; Ward et al. JAVMA 2017, 2020). Typically, these "Global FAST® Non-echo Fallback Views" are easier to acquire in critical patients than the TFAST® echo views. See Global FAST Proceedings for greater detail. *Image provided by Dr. Gregory Lisciandro, DVM, DABVP, DACVECC, FASTVet.com and Hill Country Veterinary Specialists Copyright 2018, 2019.*

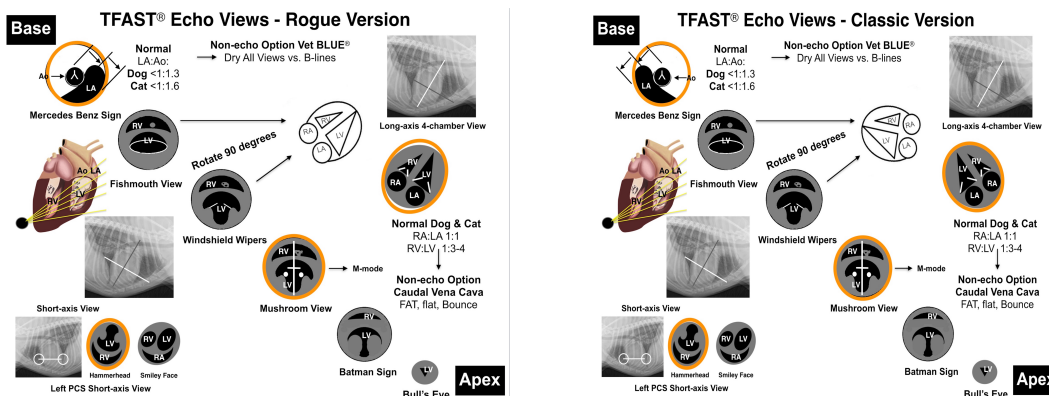


Figure. The TFAST® Echo Chart Rogue (head to the left of the screen as all other ultrasound is performed) and Classic Versions (head to the right of the screen as oddly the cardiologist have traditionally reversed the imaging). These charts provide a means to learn what level of the heart you are imaging to better communicate and direct the probe to the level you want to get to for the information needed. The major TFAST® Echo views are circled in orange with the long-axis left ventricular outflow tract view not shown. Importantly, volume status at the "Batman" level will be mistaken for poor volume when in fact the sonographer is imaging at the incorrect level. Names for the short-axis levels along the "TFAST® Cardiac Ladder" have been created. The normal ratios, "Global FAST® Non-echo Fallback Views", and when to rotate the probe for the long-axis views are also listed on this TFAST® Echo Chart., when studied carefully. The "short-axis" and "long-axis" imaging lines are superimposed on a lateral radiograph; and the left TFAST Pericardial short-axis view of the heart is shown with its imaging line and its unique "Hammerhead" and "Smiley Face" views with arrows and circles showing the left "TFAST® Slide." *Image provided by Dr. Gregory Lisciandro, DVM, DABVP, DACVECC, FASTVet.com and Hill Country Veterinary Specialists Copyright 2018, 2019.*

The TFAST® Diagnosis of Pericardial versus Pleural Effusion

When performing the TFAST® left and right PeriCardial Site (PCS) 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 hyperechoic (bright white) 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 (short-lived acoustic windows) due to air interference from lung. The concept is illustrated in the images below.

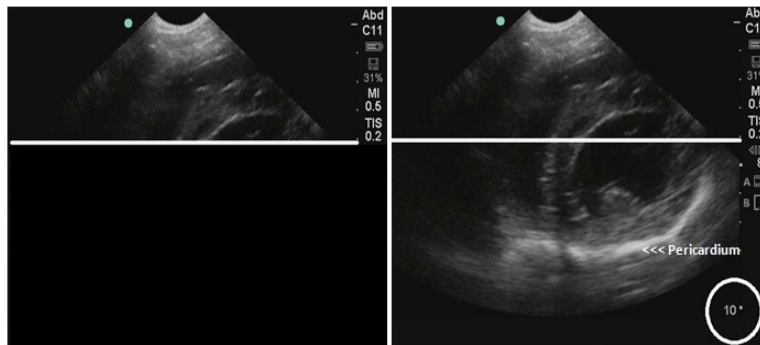


Figure. Make Sure You Image the Heart in Its Entirety. Shows how having *too shallow depth* can lead to serious mistakes. To the left, the image shows how it is difficult to accurately distinguish pleural or pericardial effusion from the crescent-shaped right ventricle, that, in haste, can be easily mistaken for pleural or pericardial effusion and its papillary muscles for pathology (see the next figure). Insist as best practice to always image the heart *in its entirety* using the hyperechoic (bright white) line of the pericardium in the far-field as your habitual landmark. *This material is reproduced with permission of John Wiley & Sons, Inc, Focused Ultrasound Techniques for the Small Animal Practitioner, Wiley ©2014 and Dr. Gregory Lisciandro, DVM, DABVP, DACVECC, FASTVet.com and Hill Country Veterinary Specialists Copyright 2018, 2019.*

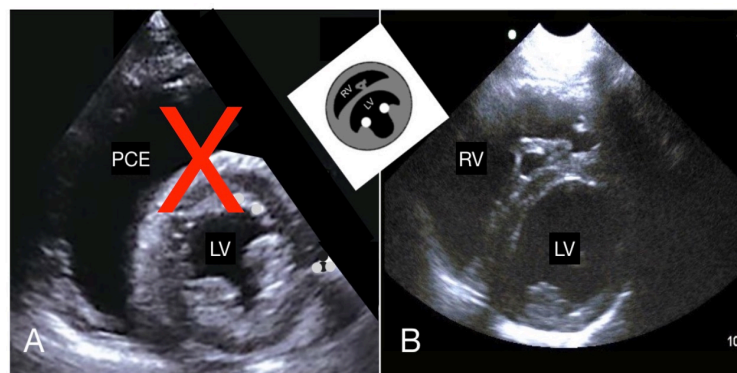


Figure. The Right Ventricle Mimicks Pericardial Effusion - The Danger of this View. The figure shows how the short-axis “mushroom” and its other short-axis views, Batman, Windshield Wipers, and Fishmouth (see TFAST® Echo Charts), are dangerous as a single view for the non-cardiologist sonographer for the following reason: the image to the left shows pericardial effusion labeled as “PCE” compared to the image to the right that shows how the normal cardiac anatomy of the crescent-shaped right ventricle (RV) can mimic pericardial (or pleural effusion). This mistake, common enough, leads to the most potentially catastrophic of interventions of performing centesis on a heart chamber (Lisciandro JVECC 2016). Best practice is *not* use the right Pericardial (parasternal) left ventricular short-axis views for pleural and pericardial effusion *unless combined with other views* because the mistake is easy to make without this TFAST® mindset. *This material is reproduced and modified with permission of John Wiley & Sons, Inc, Focused Ultrasound Techniques for the Small Animal Practitioner, Wiley ©2014 and Dr. Gregory Lisciandro, DVM, DABVP, DACVECC, FASTVet.com and Hill Country Veterinary Specialists Copyright 2018, 2019.*

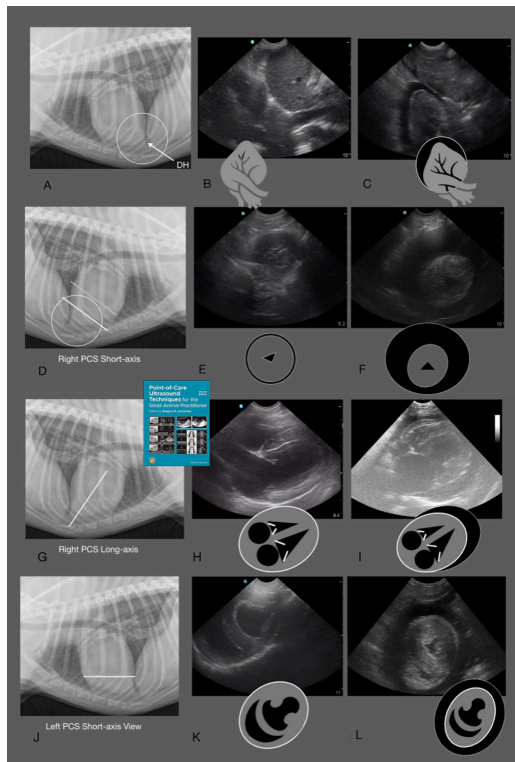


Figure. Pericardial Effusion Composite. In the first column are didactic radiographic images showing the scanning planes for each respective row of images of which there is normalcy to the right of each radiograph followed by pericardial effusion for that respective view. Note that the “Hammerhead View” from the left TFAST PCS view is also an acceptable view (see TFAST Echo Chart), because there are only 2 heart chambers located there, the left and right ventricles, and both ventricles may be clearly identified with fluid outside of them. Thus, it is difficult on both the long-axis 4-chamber view (G,H,I) and “Hammerhead View” (J,K,L) to mistake a heart chamber for pericardial (or pleural) effusion. *With Permission, Wiley Blackwell, Point-of-Care Ultrasound for the Small Animal Practitioner, 2nd Edition, © 2020.*

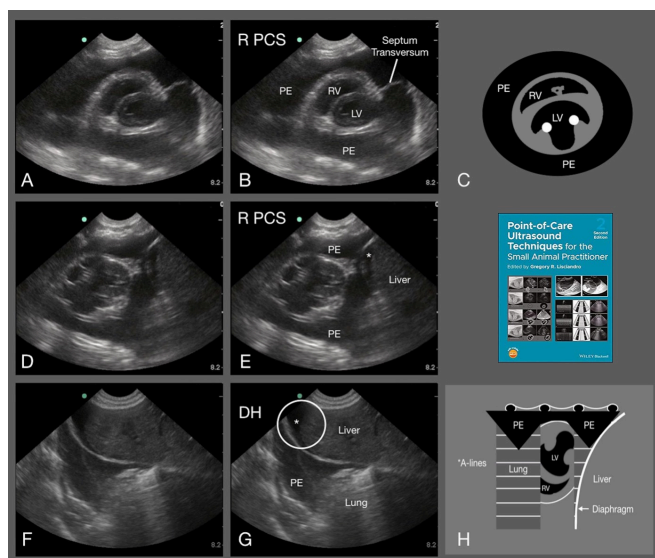


Figure. Pleural Effusion Composite. Shown are examples for pleural effusion from the TFAST PCS views and the TFAST-AFAST DH view. Note how triangulations similar to ascites exist for pleural effusion, unlike

pericardial effusion, that is rounded being contained within the pericardial sac. Another manner in which to diagnose pleural effusion is by default, in other words, it is *not* pericardial effusion, which is much easier to identify, and thus is pleural effusion. *With Permission, Wiley Blackwell, Point-of-Care Ultrasound for the Small Animal Practitioner, 2nd Edition, © 2020.*

TFAST® Diagnosis of Pericardial Effusion		
The Gold Standard for the Diagnosis of Pericardial Effusion is Ultrasound Radiography is Unreliable Pericardial Effusion is Contained in the Pericardial Sac that Attaches at One Atrium and Rounds the Muscular 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-field as a landmark	Make Habitual Best Practice for Echo Views	Make Habitual Best Practice for Echo Views
TFAST® 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-field 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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The Use of TFAST® for Pneumothorax

Pneumothorax and The Lung Point. The TFAST® Chest Tube Site (CTS) view should be recognized as along the highest reasonable location over the pleural cavity where air would rise in the presence of pneumothorax (PTX). Thus, if there is evidence that lung is opposed to the intercostal space-thoracic wall by either observing "Lung Sliding" (previously called the "Glide Sign") or B-lines (also called ultrasound lung rockets), then pneumothorax is rapidly *ruled out* (Lisciandro et al. JVECC 2008).

Search for the Lung Point. When pneumothorax (PTX) is suspected, then search for the “Lung Point”, the location where there is evidence that lung re-contacts the thoracic wall, in other words, the transition zone of pneumothorax dorsally and lung ventrally, and importantly, when your patient is in standing or sternal (Lisciandro JVECC 2008, 2011). The “Lung Point” is best thought of as moving through the Perihilar and Middle Lung Regions of Vet BLUE and then moving in smaller increments dorsal from where evidence of lung opposing the thoracic wall is observed. The severity of PTX may be estimated by using the "TFAST® PTX 1/3s Rule" by the “Lung Point” location as follows: upper 1/3 - trivial, middle 1/3 - moderate, and lower 1/3 – severe. If the Lung Point is middle 1/3 or lower 1/3, deemed "moderate" and severe" respectively, then patient in the author's experience should have thoracocentesis performed. The “TFAST® PTX 1/3s Rule” serves not only as a means semi-quantitate PTX severity, but also as a means to monitor (track) PTX as being static, worsening, or resolving.

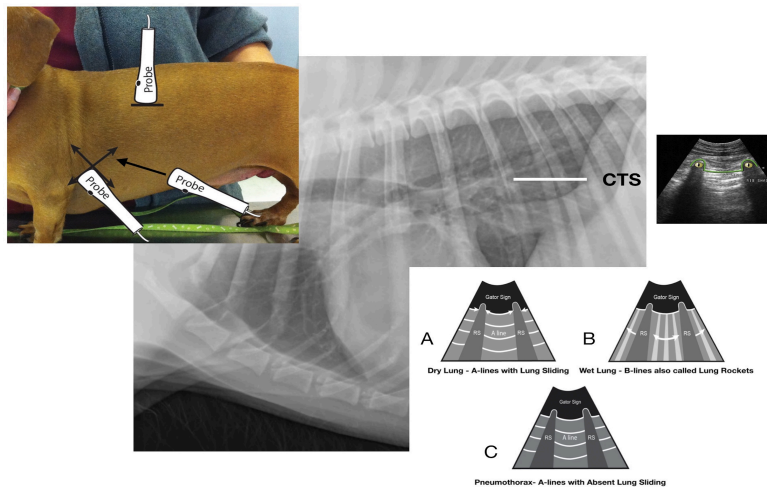


Figure. Left TFAST® Chest Tube Site. Shows the left TFAST® Chest Tube Site (CTS) view as along the highest reasonable location over the pleural cavity where air would rise. Thus, if there is evidence that lung is opposed to the intercostal space-thoracic wall by either observing "Lung Sliding" (previously called the "Glide Sign") or B-lines (also called ultrasound lung rockets), then pneumothorax is rapidly *ruled out* (Lisciandro et al. JVECC 2008). PTX is ultrasonographically characterized by A-lines *withOUT* lung sliding. The Gator Sign is necessary to establish proper lung ultrasound orientation and assures accuracy for identification of the pulmonary-pleural interface, the "Lung Line." When PTX is suspected, then searching for the “Lung Point” is next performed (see below). *This material is reproduced and modified with permission JVECC 2011; 20(2): 104-122; and John Wiley & Sons, Inc., Focused Ultrasound Techniques for the Small Animal Practitioner, Wiley ©2014 and FASTVet © 2014 and Dr. Gregory Lisciandro, DVM, DABVP, DACVECC, FASTVet.com and Hill Country Veterinary Specialists Copyright 2018, 2019.*

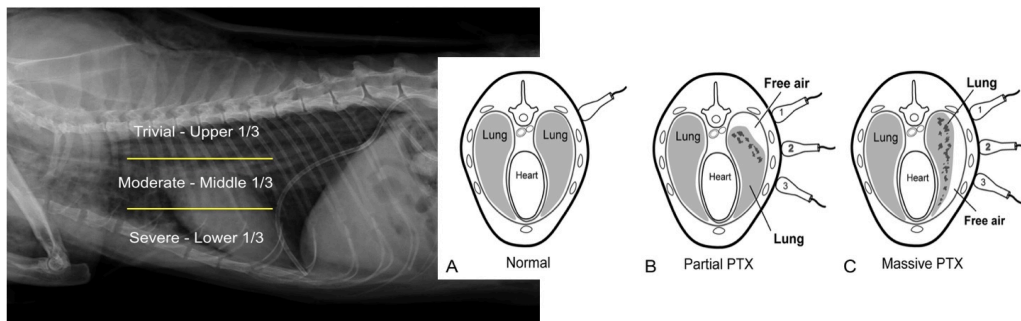


Figure. Searching for the Lung Point. When pneumothorax (PTX) is suspected, then search for the “Lung Point”, the location where there is evidence that lung re-contacts the thoracic wall, in other words the transition zone of pneumothorax dorsally and lung ventrally, when your patient is in standing or sternal (Lisciandro JVECC 2008, 2011). The “Lung Point” is best thought of as moving through the Perihilar and Middle Lung Regions of Vet BLUE and then moving in smaller increments dorsal from where evidence of lung opposing the thoracic wall is observed. The severity of PTX may be estimated by using the “TFAST® PTX 1/3s Rule” by the “Lung Point” location as follows: upper 1/3 - trivial, middle 1/3 - moderate, and lower 1/3 – severe. The thoracic lateral radiograph is from a cat with a thoracostomy tube. The feline patient may be effectively evaluated using TFAST® for the presence and absence and degree of PTX *prior to* and *after the tube’s* removal. Thus, the “TFAST® PTX 1/3s Rule” serves not only as a means semi-quantitate its severity, but also as a means to monitor (track) PTX as being static, worsening, or resolving. *This material is reproduced and modified with permission JVECC 2011; 20(2): 104-122; and John Wiley & Sons, Inc., Focused Ultrasound Techniques for the Small Animal Practitioner, Wiley ©2014 and FASTVet © 2014 and Dr. Gregory Lisciandro, DVM, DABVP, DACVECC, FASTVet.com and Hill Country Veterinary Specialists Copyright 2018, 2019.*

Clinical Indications/Applications for TFAST®

The use of *standardized* TFAST® and Vet BLUE® should serve as routine as an “extension of the physical exam” for all dogs and cats that are abnormal or respiratory suspects (*better* the Global FAST® Approach). Questionable findings within the thorax using the FAST DH View should be confirmed via TFAST® PCS View(s) or Vet BLUE® or both and by serial exams, repeating TFAST® and Vet BLUE® at least once 4-hours later.

Global FAST® is Our New Quick Assessment Test

The Global® FAST Approach is the *better* strategy because it provides an unbiased imaging data set on all patients through its 15-standardized acoustic windows while avoiding "satisfaction of search error", a major problem of the veterinary point-of-care (V-POCUS) movement, in which ultrasound imaging is “*selective*” with a picking and choosing approach leading to “selective imaging” and confirmation bias, and “satisfaction of search error”, stopping the search at the first abnormality, thus, carrying the potential to miss other important information. In summary, the Global FAST® Approach is an extension of the physical exam, serving as a screening test for free fluid *and* soft tissue examination of the abdomen, retroperitoneal space and thorax, including heart and lung.

Goal-Directed Templates for TFAST®

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

***Chest Tube Site (CTS) - Glide Sign?** **Present** (normal) -- no Pneumothorax **or**
Absent – Pneumothorax **or Indeterminate** **or Not Assessed**

***Location of Lung Point?** **Upper 1/3** **or Middle 1/3** **or Lower 1/3** **or Indeterminate** **or Not Assessed**

***CTS - Lung Rockets (also called B-lines)?** **Present** (no PTX) – interstitial lung fluid (edema, hemorrhage)
or Absent – no interstitial lung fluid
or Indeterminate
or Not Assessed

***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**
or **Not Assessed**

***PCS view - Pleural or Pericardial Eff.?** **Absent**- no pleural or pericardial fluid
or **Present** - pleural or pericardial fluid or both (mild, moderate, or severe)
or **Indeterminate**
or **Not Assessed**

TFAST Echo® Views:

Left Ventricular Short-axis Mushroom View (LVSA): Filling: **Adequate** suggesting normovolemia
or **Inadequate** suggesting hypovolemia
or **Indeterminate**
or **Not Assessed**
Contractility: **Unremarkable** or **Decreased** or
Indeterminate or **Not Assessed**

Left Atrial to Aortic Ratio (LA:Ao) on Short-axis:
Unremarkable or **Increased** or **Indeterminate** or **Not Assessed**

Right Ventricular to Left Ventricular Ratio (RV:LV) on Long-axis:
Unremarkable or **Increased** or **Indeterminate** or **Not Assessed**

DH View: **Pleural effusion:** **Absent**
or **Present (mild, moderate, severe)**
or **Indeterminate** or **Not Assessed**
Pericardial effusion: **Absent**
or **Present (mild, moderate, severe)**
or **Indeterminate** or **Not Assessed**

§**Hepatic Venous Distension:** **Present** or **Absent** or **Indeterminate**
or **Not Assessed**

&**Caudal Vena Cava Characterization:** **FAT** or **flat** or **bounce** or **Indeterminate**
or **Not Assessed**

Cardiac Tamponade: **Present** or **Absent** or **Indeterminate** or **Not Assessed**

Comments: _____

KEY: **CTS** = chest tube site; **PCS** = pericardial sac; **LV** = left ventricle, **PTX** = pneumothorax, **NA** = Not Assessed

Note: The TFAST 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, help better direct diagnostics, and manage hospitalized critically ill patients. TFAST³ exam is not intended to replace thoracic radiographs, or complete echocardiography.

§The hepatic veins should *not* be apparent in both dogs and cats placed in lateral recumbency or standing or sternal. When imaged, the branching has been referred to as the "Tree Trunk Sign."

&The caudal vena cava can be alternatively referred to as a bounce = fluid responsive cava (~35-50% diameter change); FAT = fluid intolerant cava (distended with increased maximum height < 1cm in dogs < 9kg, and > 1.5cm in dogs > 9kg with little maximum height change [< 10%]); flat = hypovolemic cava (small with decreased maximum height of < 0.3cm in dogs < 9kg and < 0.5cm in dogs > 9kg with little maximum height change [< 10%]). See *Global FAST Monitoring Proceedings*.

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Other current Goal-directed Template AFAST[®], TFAST[®], Vet BLUE[®] and Global FAST[®] versions may be found at FASTVet.com under the Premium Membership, then Resource Library, and then Free Resources.

References & Further Reading

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13. **Lisciandro GR**. Chapter 55: Ultrasound in Animals. In: *Critical Care Ultrasound (human textbook)*, Editors Lumb and Karakitsos. Elsevier: St. Louis MO, 2014.

See also Vet BLUE[®] Proceedings for additional References.