

AFAST Introduction to Its Target Organ Approach and Fluid Scoring System

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Learning Objectives

- Understand AFAST® image acquisition of its 5 views and the focused spleen
- Understand AFAST® and its target organ approach for soft tissue abnormalities
- Understand the AFAST® abdominal fluid scoring system and its small volume versus large volume bleeder/effusion concept
- Understand AFAST® advantages over physical exam, laboratory testing, and radiography
- Understand how a 3-minute AFAST® examination can provide a large amount of clinical information on the abdomen and thorax

Introduction

The clinical utility of AFAST®, its target-organ approach and its applied fluid scoring system in virtually all subsets of patients including trauma, triage (non-trauma) and tracking (monitoring) cases in the emergent and critical care settings will be reviewed. The previously published T³ designation encompasses these 3 subsets, Trauma, Triage (non-trauma), and Tracking (monitoring) and avoids the onslaught of confusing acronyms in human and now veterinary medicine in which similar abbreviated formats are given different acronyms when applied to different subsets of patients. However, AFAST® is in reality "an extension of the physical examination" and the T³ designation is unnecessary as more and more veterinarians understand its applications. Thus, AFAST® becomes a universal term that has *exact* clarity of its 5-acoustic windows or views.

The AFAST® 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 evaluation of physical examination, laboratory testing, and radiographic finding. AFAST® findings are made more clinically relevant for the clinician, client, and referring veterinarian by using its standardized ultrasound format, and by recording AFAST® findings on standardized goal-directed templates for medical records (see below).

The mindset for those using AFAST® is one of a *ruling in* and *ruling out* test (highly specific and highly sensitive) for the presence or absence of free fluid, and a *ruling in* test for soft tissue abnormalities of its target-organ (highly specific and variably sensitive being user-dependent). In other words, AFAST® serves as a screening test for obvious abnormalities of its target-organs, meaning if you see the abnormality it's likely real, however, if you don't see an abnormality, then it may have been missed, being user dependent. Importantly, the AFAST® does not replace a complete detailed abdominal ultrasound.

Moreover, AFAST® serves as a means to better survey veterinary patients and to better keep alive for gold standard testing and treatment. Along with its AFAST®-applied abdominal fluid scoring system, AFAST® helps decision-making regarding medical versus surgical cases including the need for blood transfusion(s), exploratory surgery, and other interventions in bleeding and non-hemorrhaging patients.

Finally, the Global FAST® Approach (combining AFAST®, TFAST® and Vet BLUE® as a single ultrasound examination), better ensures that more traditional complete ultrasound studies are ordered (and other imaging studies) for the *correct* cavity and that it is safe to restrain the patient, especially for dorsal recumbency.

The standardization and clarity of Global FAST® is the author's recommended approach for using FAST and point-of-care ultrasound (POCUS) because it avoids "selective imaging" and "satisfaction of search error." "Selective imaging" leads to "confirmation bias error", 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; and should preempt all other point-of-care ultrasound 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.* In summary, the Global FAST® approach is a 3rd standardized veterinary ultrasound examination for patient imaging and should be a first line extension of the physical exam in most if not all patients.

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/Hemorrhage 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, accurately 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, lack of 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. *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 are erroneously and misleadingly used by our colleagues.*

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 should be used as a baseline set of unbiased data imaging points surveying both cavities and then POCUS or Focused Exams used 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, AFAST® and Global FAST® are performed in standing. In AFAST®-negative standing (sternal) patients, lateral recumbency is unnecessary. If 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 those 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 gooey (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 for most patients only adding more time and are generally reserved for more complete detailed examinations.

Preset. The entire AFAST® and Global FAST® are performed with the abdominal preset. Preset may be changed, but by doing so generally only adds time and changing presets may be reserved for more complete detailed examinations.

Probe Maneuver. The probe maneuvering is standardized. The probe is fanned, rocked cranially and returned to the starting point at each AFAST® view. We base this probe maneuvering on the original veterinary FAST study that showed when comparing longitudinal to transverse views, they matched 397/400 times for the detection of free fluid. *All AFAST® views are imaged by fanning, rocking cranially and returning to the starting point.*

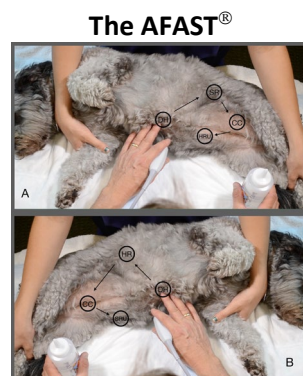


Figure. The AFAST® views used for abdominal fluid scoring are shown on a dog and analogous for cats (and non-human primates and exotic companion mammals). The Hepato-Renal Umbilical view has been renamed the Spleno-Intestino Umbilical (SIU) view. Note: not shown is the Hepato-Renal 5th Bonus view when in right lateral and the Spleno-Renal 5th Bonus view when in left lateral recumbency. *This material is reproduced with permission of John Wiley & Sons, Inc., Point-of-Care Ultrasound Techniques for the*

AFAST® Order. The AFAST® regardless of positioning (standing/sternal, right lateral recumbency) is always performed in the same order beginning at the Diaphragmatico-Hepatic (DH) view, followed by the least gravity dependent Spleno-Renal (SR) view, then the Cysto-Colic (CC) view, completing the AFAST® at the most gravity dependent Spleno-Intestino Umbilical (SIU) view, where abdominocentesis is performed in most fluid-positive patients. The spleen is generally identified in this region (SIU) and then followed performing a Focused Spleen. In left lateral recumbency the order is analogous with the Hepato-Renal (HR) view replacing the Spleno-Renal view. As with right lateral recumbency, a Focused Spleen is performed *after* completing these 4 views of the AFAST fluid scoring system. However, in left lateral recumbency the spleen is more problematic to image because it courses under the patient to the left kidney.

Diaphragmatico-Hepatic (DH) view. Target organs are liver, gallbladder and the heart, lung, and pleural cavity looking beyond (cranial to) the diaphragm and the caudal vena cava and its associated hepatic veins as it traverses the diaphragm. They are imaged in longitudinal planes with fanning, rocking cranially, and returning to your starting point.

Spleno-Renal (SR) view. Least gravity-dependent view. Target organs are left kidney and spleen where it is attached to the greater curvature of the stomach via the short gastric vessels. They are imaged in longitudinal planes with fanning, rocking cranially, and returning to your starting point. The stomach and colon are deep to the target-organs and often air-filled, shadowing through the far field. This view would be used for the detection of pneumoperitoneum (air would rise).

Cysto-Colic (CC) view. Target organ is the urinary bladder with the acknowledgement of the colon that when air-filled obscures imaging. Probe (scanning plane) is directed into the most gravity-dependent “CC Pouch.” They are imaged in longitudinal planes with fanning, rocking cranially, and returning to your starting point. The thigh is often seen through the far field. In predominately intact species, such as non-human primates and exotic companion mammals, the sex organs, especially the uterus, should be part of this view.

Hepato-Renal Umbilical (HRU) view, now named Spleno-Intestino Umbilical (SIU) view. Misnomer. The view previously designated the “Hepato-Renal Umbilical (HRU) view” has been renamed the Spleno-Intestino Umbilical (SIU) view because its target organs are the spleen and intestine. Neither the right kidney nor the right liver is imaged. The probe is placed at the level of the umbilicus and imaged its scanning plane into the most gravity-dependent “Umbilical Pouch.” In standing or sternal, the probe as placed on the umbilicus, Fanning, rocking cranially, and returning to the starting point is the same probe maneuver at all AFAST® views. In predominately intact species, such as non-human primates and exotic companion mammals, the sex organs, especially the uterus, should be part of this view. Again, this view has been renamed as the “Spleno-Intestino Umbilical view.”

AFAST® Target-Organ Approach. AFAST® was developed having a target-organ approach by the renaming of its acoustic windows from its creation in 2005. Target organs are fanned through each respective view and obvious soft tissue abnormalities, many of which are only suspected or missed based on physical exam, introductory blood and urine testing, and radiography are detected. “Seeing your problem” list is the mantra. The sonographer doesn’t need to identify the exactness of the abnormality, but rather recognize that the view deviates from the expected. The word “suspect” is used for any deviations from the expected.

Diaphragmatico-Hepatic View (DH):

Liver: masses, cysts, heterogeneous echogenicity

Gallbladder: sediment/sludge, mucoceles, wall abnormalities, common bile duct distension

Caudal vena cava and hepatic veins: distension, microfilaria, thrombi, masses
Lung: B-line, signs of consolidation

Spleno-Renal View (SR):

Left Kidney: mineralization, calculi, pyelectasia, hydronephrosis, cortical cysts, perinephric cysts, ureteral distension, cortical infarction, masses
Spleen: masses, heterogeneous echogenicity (lymphoma, torsion)
Retroperitoneal Space: masses, thrombi, free air

Cysto-Colic View (CC):

Urinary bladder: sediment, calculi, thrombi, masses
Uterus: fluid-filled (pyo-, hydro-, mucometra), pregnancy
Caudal abdominal masses

Spleno-Intestino Umbilical View (SIU):

Spleen: masses, heterogeneous echogenicity (lymphoma, torsion)
Small Intestine: ileus and distension, wall abnormalities, masses, mid-abdominal masses, gastric distension, hepatomegaly

Focused Spleen:

Spleen: masses, heterogeneous echogenicity (lymphoma, torsion), thrombi, infarction

Hepato-Renal 5th Bonus View:

Right Kidney: mineralization, calculi, pyelectasia, hydronephrosis, cortical cysts, perinephric cysts, ureteral distension, cortical infarction, masses
Right Liver: masses, cysts, heterogeneous echogenicity

Add-on skills include the detection of pneumoperitoneum by the enhanced peritoneal stripe sign, the twinkle artifact for mineralization and small calculi, gastrointestinal motility, and estimation of urinary bladder volume. Renal perfusion has also been assessed using ultrasound.

AFAST[®]-applied Abdominal Fluid Scoring System

See Proceedings for “The AFAST-Applied Abdominal Fluid Scoring System for Decision-Making in Bleeding Patients.”

Clinical Indications for AFAST[®]

The use of AFAST[®] should be simply stated as an “extension of the physical exam”--in other words everyday applications for nearly every patient. *Global FAST[®] should be your first line “free fluid and soft tissue screening test” because it exceeds the yield radiographically in the great majority of our patients and should be part of a work-up as blood and urine testing are.* Think about long list of effusive and soft tissue conditions missed or only suspected by radiography that are detected using the AFAST[®] target-organ approach.

In summary, AFAST[®] is an extension of the physical exam and used for triaged trauma, non-trauma and post-interventional cases, your pre-anesthetic test, your geriatric screening test, part of patient rounds and recheck exams, and for surveying patients with shock and part of basic and advanced life support in cardiopulmonary resuscitation.

GOAL-DIRECTED TEMPLATE FOR AFAST[®]

Patient positioning:	right or left lateral recumbency, standing or sternal
Gallbladder:	present or absent, contour, wall, content, unremarkable or abnormal
Urinary bladder:	present or absent, contour, wall, content, unremarkable or abnormal

Positive or negative at the 4-views (0 negative, 1 positive)

Diaphragmatico-Hepatic (DH) site:	0 or 1/2 or 1
Spleno-Renal (SR) site:	0 or 1/2 or 1
Cysto-Colic (CC) site:	0 or 1/2 or 1
Spleno-Intestino Umbilical (SIU) site:	0 or 1/2 or 1

Total Abdominal Fluid Score (0-4): _____

HR 5th Bonus View: 0 or 1/2 or 1 or indeterminate or not assessed (NA)

Focused Spleen (*add-on after completing the AFAST® HR Umbilical View*): _____

DH View:

Pleural effusion: absent, present (mild, moderate, severe) or indeterminate or NA

Pericardial effusion: absent, present (mild, moderate, severe) or indeterminate or NA

§Hepatic venous distension: unremarkable or present (Tree Trunk Sign) or indeterminate or NA

&Caudal vena cava characterization: bounce (unremarkable) or FAT or flat or indeterminate or NA

#Vet BLUE: B-lines: 0, 1, 2, 3, >3, or ∞ and if Shred__cm, Tissue__cm, Nodule__cm, Wedge__cm

Comments: _____

Note: The AFAST® is a rapid ultrasound examination used to detect the presence of free abdominal fluid and obvious soft tissue abnormalities as a screening test in order to better direct resuscitation efforts and diagnostics, detect complications, and manage patients. AFAST® is not intended to replace a complete detailed abdominal ultrasound exam.

§The hepatic veins should *not* be apparent in both dogs and cats placed in lateral recumbency. When imaged the branching has been referred to by the author 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 maximum height > 1 cm in dogs < 9kg and > 1.5 cm in dogs > 9kg with little height change [< 10%]); flat = hypovolemic cava (small with maximum height < 3 mm in dogs < 9 kg, < 5 mm in dogs > 9 kg with little height change [< 10%]).

#Vet BLUE screens for lung abnormalities along the pulmonary-diaphragmatic interface.

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