Introduction
The clinical utility of AFAST® and the applied fluid scoring system trauma, triage (non-trauma) and tracking (monitoring) cases in the emergent and critical care settings will be reviewed. The T® designation encompasses these 3 subsets, trauma, triage (non-trauma), and tracking (monitoring) and avoids the onslaught of confusing acronyms in human medicine in which similar abbreviated formats are given different acronyms when applied to different subsets of human patients. Thus, AFAST® becomes a universal term that has exact clarity of its 4-acoustic windows used by the veterinary sonographer for the abdominal fluid scoring system and its 5th bonus view.

The AFAST® ultrasound exam has greater potential to positively guide clinical course and improve patient outcome by detecting conditions and complications otherwise occult based on traditional means of physical examination, laboratory and radiographic findings, and avoiding the common delay associated with more advanced imaging (often jeopardizing patient care). Finally, AFAST® findings are made more clinically relevant for the clinician, client, and referring veterinarian by using a standardized ultrasound format (AFAST®), and 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 of target-organ pathology (highly specific and variably sensitive - meaning if you see the abnormality it's likely real vs. if you don't see the abnormality you may have missed it); and that AFAST® is a means to better survey veterinary patients keeping them alive for gold standard testing and treatment; and that AFAST® helps better decision-making regarding medical vs. surgical cases; and in bleeding patients the need for blood transfusion(s) and/or exploratory surgery. Finally, the Global FAST® approach, AFAST, TFAST and Vet BLUE combined as a single exam, better ensures that more traditional complete studies are ordered for the correct cavity.

Terminology
In the human literature, there has been a confusing onslaught of multiple acronyms for similar ultrasound examinations by non-radiologists. Veterinarians would be best served by using AFAST®, TFAST® (thoracic) and Vet BLUE® (lung exam). When all 3 formats are used together the exam is referred to a Global FAST®. Because Global FAST and any of the three AFAST, TFAST and Vet BLUE ultrasound formats may be diagnostic, the author suggests that comprehensive exams of the abdomen and thorax be designated as “complete abdominal ultrasound” and “complete echocardiography” respectively, similar to the human literature. Finally, terms such as “Focused” and “Targeted” and “COAST” have been used for specific sonographic interrogation of organs in both human and veterinary medicine. However, focused organ exams and traditional complete exams may not be ordered for the correct system or cavity, thus we strongly advocate for Global FAST as a first line screening soft tissue and free fluid exam to better pick the next best test and avoid missing potentially serious conditions. This concept has been recently advocated in human medicine.

Defining Global FAST
Global FAST is the combination of AFAST and its Target-organ Approach and its Abdominal Fluid/Hemorrhage Scoring System, TFAST including 4 echo views, and Vet BLUE (lung). The approach is not a “flash exam” and these terms should never be applied to a “flash approach.”

Patient Positioning and Preparation
Right lateral recumbency (over left lateral recumbency) is recommended because right lateral recumbency is the standard positioning for electrocardiographic and echocardiography evaluation; the left kidney at the SR view is more easily and reliably imaged (vs. the more cranially located right kidney often under the rib cage); and the gallbladder via the DH view is readily imaged by directing the probe slightly toward the table top. Lastly, the spleen located predominantly left of midline is arguably
less apt to incur iatrogenic puncture via abdominocentesis. However, BOTH right and left lateral recumbency are validated for the abdominal fluid scoring system. AFAST\textsuperscript{3} should never be performed in dorsal recumbency because it not only invalidates the fluid scoring system, but jeopardizes injured and critically ill patients by compromising their respiratory status and venous return. In respiratory compromised patients, TFAST\textsuperscript{4} and Vet BLUE are performed in sternal or standing prior to AFAST and a cursory or delayed AFAST is then performed. The AFAST\textsuperscript{3} target-organs may still be imaged in standing or sternal; however, the abdominal fluid scoring system will not be valid in cases positive for free fluid. Fur is NOT shaved but rather parted with 70% isopropyl alcohol and then as needed the addition of acoustic coupling gel or alcohol based hand sanitizer (author preference). 70% isopropyl alcohol should not be used if electrical defibrillation is anticipated. Hand sanitizer when compared to 70% isopropyl alcohol and acoustic coupling gel is advantageous being less noxious and cooling than 70% isopropyl alcohol and less gooey than commercially available acoustic coupling gel. Make every attempt to part the fur and place the probe as directly as possible on skin to minimize air-trapping between the probe head and the skin.

The AFAST\textsuperscript{3} Examination

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The HR view is now considered the HR Umbilical view and should be labeled "HRU" as the probe is placed at the most gravity-dependent region in lateral or standing and sternal recumbency at the level of the umbilicus and not run under the patient.

The AFAST\textsuperscript{3} sites shown in right lateral recumbency. To the right of the pictorial labeled A) is a translational depiction on an abdominal radiograph of a dog. The AFAST\textsuperscript{3} should always be performed in a standardized counter-clockwise manner as follows: 1) Diaphragmatico-Hepatic (DH) View also used to image the pleural and pericardial spaces. 2) Spleno-Renal (SR) View also used as a window into the retroperitoneal space. 3) Cysto-Colic (CC) View and 4) Hepato-Renal (HRU) Umbilical View which completes the AFAST\textsuperscript{3} exam. The HR Umbilical view in higher-scoring dogs and cats is often a favorable site for abdominocentesis. In left lateral recumbency the order would be DH to HR to CC to SR Umbilical views. All AFAST\textsuperscript{3} views are performed in the longitudinal (sagittal) orientation because it is easier to appreciate the anatomy of the respective target-organs and less confusing especially for the novice sonographer. Importantly, Boysen et al. showed that when comparing longitudinal (sagittal) to transverse views, they matched 397/400 times for the detection of free fluid. Thus, keeping it simple with fanning (and rocking) through only longitudinal planes expedites the learning process.

**AFAST-Applied Fluid Scoring System**

The AFAST\textsuperscript{3}-applied fluid scoring system is defined as follows (4-point scale): abdominal fluid score (AFS) of 0 (AFS 0) means negative at all 4 views to a maximum score of AFS 4 means positive at all 4 views.

*Low-scoring AFS 1 and 2 are considered major injury/pathology, small volume bleeders.*

*High-scoring AFS 3 and 4 are considered major injury/pathology, large volume bleeders.*


The AFAST-applied is hugely impactful and should be applied and recorded in every patient. It’s a simple 0-4 scoring system and has significant advantages over subjective terms of mild, moderate and severe. Not only does the patient’s abdominal fluid score (AFS) semi-quantitate the volume, but also helps with origin of bleeding or effusion in lower-scoring patients. For example, in a bleeding trauma patient that has an AFS of 1 and positive at the DH view, that over time becomes a large volume bleeder as an AFS 4, logic would dictate the source of bleeding is likely the liver and/or its associated vasculature. The AFS helps
rapidly categorize the patient as a small volume (AFS 1 and 2) vs. large volume bleeder (AFS 3 and 4). AFS 1 and 2 do not have enough blood intra-abdominal to result in anemia. Thus, if an AFS 1 or 2 is anemic there are the following 4 scenarios: 1) preexisting anemia, 2) bleeding somewhere else (always do Global FAST), 3) hemodilution (less common with graduated fluid therapy strategies), or 4) lab error. The AFS allows tracking of worsening (increasing AFS), resolving (decreasing AFS), or static (no change in AFS).

Modification of the Abdominal Fluid Scoring System - 0 or 1/2 or 1
The author for several years has been categorizing positives as "soft" if the maximum pocket is < 1 cm (< 5 mm in cats) scoring as a "1/2" vs. a hard positive if > 1 cm (> 5 mm in cats) making the score a full "1." The small vs. large volume bleeding concept remains as AFS 1 and 2 small volume, and AFS 3 and 4, large volume bleeders. Clinical judgment always should be considered; however, this modification provides an option to better assess and semi-quantitate volume in bleeding patients and those with other forms of ascites and peritonitis. The modification of our original scoring system is currently being studied by the author.

Figure. A cartoon of a cat in lateral recumbency to the left and a dog to the right and the modification of the abdominal fluid score to better differentiate between small volume and large volume bleeding (and other forms of ascites and peritonitis) by assigning a score of 1/2 vs. a hard positive if > 1 cm (> 5 mm in cats) that would now be deemed a small volume bleeder (if a bleeding case) with a score of 1 1/2 rather than a "3"; using the same categorization of AFS 1 and 2 and AFS 3 and 4 as small and large bleeders, respectively. Copyright 2018 Gregory Lisciandro, DVM, DABVP, DACVECC and FASTVet.com and Hill Country Veterinary Specialists and Illustration by Hannah Hey, San Antonio, TX.

Use of Serial AFAST and Determining the AFS
The use of serial AFAST and serial application of the abdominal fluid score is imperative to maximize information and improve sensitivity of the exam including searching for fluid, assessing the abdominal fluid score (0-4), and evaluating the presence or absence of the urinary bladder. The author performs 4-hour post-admission serial AFAST and AFS in all stable patients (sooner if unstable); and serial FAST exams 4-hours post-admission are standard of care in human medicine since 2001 by the American College of Emergency Physicians Guidelines (www.acep.org).

Traumatic Hemoabdomen
The clinical utility of the AFAST-applied fluid scoring system as predictor of anticipated degree of anemia and need for blood transfusion was shown in dogs with traumatic hemoabdomen. Dogs with negative fluid scores (AFS 0), and as low-scopers (AFS 1 and AFS 2) that had no other sources of blood loss apparent on physical exam and AFAST and TFAST imaging (no free fluid in retroperitoneal, pleural and pericardial spaces), predictably did not develop anemia. For example, in dogs with normal admission packed cell volume, low-scoring AFS 1 and 2 dogs that remained AFS 1 and 2 during their hospitalization on serial exams, rarely became anemic from their intra-abdominal hemorrhage; and if anemia did occur it was mild > 30% in dogs, > 24% in cats. Therefore, a general guideline used by the author is that if the PCV < 30% in an AFS 1 or 2 dog (or < 24% in a cat), the attending should look elsewhere for the source of bleeding, i.e. retroperitoneal and pleural spaces, fracture sites, and then only then consider the possibility of hemodilution. Although not determined in the AFAST study, clinicians should keep in mind that AFAST does not interrogate the intra-pelvic region effectively and that significant bleeding in dogs and cats through pelvic fractures and femoral fractures, although uncommon, is a possibility that could lead to anemia and missed by AFAST and TFAST. So in AFS 1, 2 dogs and cats that are anemic, the rule out list is: 1) preexisting anemia, 2) bleeding at another site, 3) hemodilution, and 4) lab error.

On the other hand, high-scoring AFS 3 and 4 dogs are more likely to develop anemia and predictably an ~25% decrease in PCV from baseline admission PCV; and with ~25% of these high-scoring dogs becoming severely anemic defined as a PCV < 25% (cats < 20%) requiring blood transfusion in the manner the author fluid resuscitates (titrated fluid therapy strategies). Bluntly traumatized dogs uncommonly require emergent laparotomy and should be treated initially with titrated fluid therapy to conservative endpoints and blood transfusion(s). The same small volume vs. large volume bleeder concept is applied to cats.
In summary, the AFAST-applied fluid scoring system is simple and easy to remember (0-4 scoring system) and provides a semi-quantification of the degree of hemorrhage; and analogous hemorrhage scoring systems have been shown to also help in clinical decision-making regarding blood transfusion and need for surgery or advanced imaging in human patients. To reiterate, bluntly traumatized dogs, i.e. hit-by-car, kicked, stepped on, falls from rooftops, uncommonly require emergent laparotomy to control their hemorrhage and often are successfully managed with judicious fluid therapy and blood transfusion(s). Cats as a species typically do not survive large volume bleeds (Lisciandro JVECC 2012); and thus trauma-related large volume effusions in felines are more likely to be due to uroabdomen. Moreover, by using the abdominal fluid score and recording locations of positive sites, not only is the volume semi-quantified, but the source is potentially localized.

**Non-Traumatic Hemoabdomen and Post-Interventional Bleeding**
The same concept may be applied to non-traumatic hemoabdomen, i.e. bleeding tumor and coagulopathic cases, and to at-risk post-interventional cases, i.e. post-surgical, percutaneous biopsy/aspirate, laparoscopy, interventional radiology, etc. The abdominal fluid scoring system applied in serial manner allows for the detection of ongoing (increasing scores), static, and resolving hemorrhage (decreasing scores). Whereas bluntly traumatized dogs and cats rarely need surgical intervention, post-interventional large volume bleeding (AFS 3 and 4) commonly requires exploratory laparotomy and surgical ligation of the bleeding source if coagulopathy has been ruled out and corrected when present.

*Summary of Abdominal Fluid Score (AFS 1,2 (small volume) vs. AFS 3,4 (large volume)) and Medical vs. Surgical Decision-making in Bleeding Dogs*  *Same concepts may be applied to cats*

| Summary of the AFAST-applied Fluid Scoring System in the Bleeding Dog and cat | Gregory Lisciandro and FASTVet.com © 2016, 2018 |
|---|---|---|
| Type of Trauma | Major Injury, Small Volume Bleeder (AFS 1,2) | Major Injury, Large Volume Bleeder (AFS 3,4) |
| **Blunt Trauma – Think Medical 1st**<br> *Blood rapidly defibrinates thus is seen acutely as anechoic black triangles.* | If stays AFS 1,2 no blood transfusion necessary if only bleeding intra-abdominally because do NOT expect anemia (PCV>35% in dogs and >24% in cats) if only bleeding intra-abdominally<br> If stays AFS 1,2 and anemic <30% in dogs and <24% in cats rule out another site of bleeding (retroperitoneal, pleural cavity, fracture site, externally) | If is an AFS 3,4 or becomes AFS 3,4 then expect anemia (<35% in dogs and <24% in cats) to develop and use graduated fluid therapy (1/3 shock dose and repeat as fluid challenge needed)<br> If becomes severely anemic <25% in dogs and <20% in cats then generally need a blood transfusion FIRST because most bleeding will stop with 1 or 2 rounds of blood transfusion +/- fresh frozen plasma; and rarely need exploratory surgery |
| **Penetrating Trauma – Think Surgical for Any Positive AFS**<br> *Blood from ripping, tearing, crushing, is often clotted and thus often missed acutely during AFAST because clotted blood looks like adjacent soft tissue; however, in time blood clots will defibrinate and become visible during AFAST, and ruptured, injured viscous organs will also leak or effuse, thus Serial Exams are Key in cases unsure if* | Think Surgical for Any Positive<br> Combine with other Clinical Findings and Surgical Indications (hernia, free air, septic abdomen, refractory pain, etc.)<br> Serial Exams are Key! - 4-hours later, 8-hours later, 12-hours later, 24-hours later, 2-days later, 3-days later, 5-days later | Think Surgical even for Any Positive<br> Combine with other Clinical Findings and Surgical Indications (hernia, free air, septic abdomen, refractory pain, etc.)<br> Serial Exams are Key! |
| | *You will miss a developing septic* | |
### Medical vs. Surgical.
- **Serial Exams are Key!** - 4-hours later, 8-hours later, 12-hours later, 24-hours later, 2-days later, 3-days later, 5-days later
- **You will miss a developing septic abdomen, pyothorax by not using this strategy**
- **Generally best to err in penetrating trauma that all cases are Surgical with ANY Positive**

| abdomen, pyothorax by not using this strategy |
| Sample Fluid When Accessible! |
| CT is the Gold Standard Imaging Test |
| Generally best to err in penetrating trauma that all cases are Surgical with ANY Positive |

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### Post-interventional Trauma – Think Medical for AFS 1,2 and Surgical for AFS 3,4
- **Large volume bleeding (AFS 3,4) is generally not going to stop without surgical ligation of the bleeding.**
- **Correct Coagulopathy if present**

| If stays AFS 1,2 on Serial Exams, then generally NOT surgical |
| Do Serial Exams to make sure does not change score and become a Large Volume Bleeder (AFS 3,4) |
| Sample Fluid When Accessible! |
| If is an AFS 3,4 and not anemic, then generally it is still best to Explore Emergently and NOT wait (if you wait you will likely have to transfuse your patient with its added extra cost and risk) |
| If is an AFS 3,4 and already anemic, transfuse as per patient assessment and Explore Emergently! |
| Sample Fluid When Accessible! |

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### Other Abdominal Effusions
Radiography is been proven to be unreliable in both human and veterinary medicine. For example in the AFAST study (Lisciandro et al. JVECC 2009), 24% of dogs with normal radiographic serosal detail were in fact positive for free intra-abdominal fluid (AFS 1-4), and 33% with decreased serosal detail were in fact negative for free intra-abdominal fluid (AFS 0). The use of the AFAST- abdominal fluid scoring system (AFS 0-4) not only is a better imaging test than radiography, but also provides a means to detect and monitor response to therapy of other non-hemorrhagic effusive conditions including for example transudates (liver/Gi disease), modified-transudates (right-sided heart failure, liver disease, splenic disease) and exudates (peritonitis). The use of the AFAST- applied abdominal fluid scoring system also is helpful for the surveillance of post-operative patients at-risk for hemorrhage and peritonitis since ultrasound is superior in sensitivity to physical examination and abdominal radiography.

### Clinical Indications for AFAST-
The use of AFAST should be simply stated as an “extension of the physical exam” for all dogs and cats that are abnormal or suspect. Global FAST should be adopted as first line “free fluid and soft tissue screening test” just as we have been trained to perform basic blood tests. There is a long list of effusive and soft tissue conditions missed by radiography, which are potentially picked up by the “AFAST Target-organ Approach.” Clinical indications include 1) Blunt trauma 2) Penetrating trauma 3) Collapse, apparent collapse 4) Undifferentiated hypotension 5) Anemia 6) Respiratory distress (since there are non-respiratory look-a-likes [hemoabdomen, cardiac tamponade, anaphylaxis, high fever, GDV, sepsis, and others]) 7) Post-interventional at-risk bleeding (surgery, percutaneous procedures, laparoscopy) 8) Post-interventional at-risk peritonitis (surgery, percutaneous procedures, laparoscopy) 9) Patient monitoring during fluid resuscitation and during hospitalized care 10) Pre-anesthetic screening test and 11) CPR.

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GOAL-DIRECTED TEMPLATE FOR AFAST®

**Patient positioning:** right or left lateral recumbency (right preferred)

**Gallbladder:** present or absent, contour, wall, content, unremarkable or abnormal

**Urinary bladder:** present or absent, contour, wall, content, unremarkable or abnormal

**Positive of 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
- Hepato-Renal Umbilical (HRU) site: 0 or 1/2 or 1

**Abdominal Fluid Score: 0-4** (0 negative all quadrants to a maximum score of 4 positive all quadrants)

HR5th Bonus View: ___________________________ or Indeterminate or Not Assessed (NA)

**Focused Spleen (add-on after 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:** present, absent or indeterminate or NA
- **Caudal vena cava characterization:** FAT, flat or bounce or indeterminate or NA

**Comments:** ___________________________

Note: The AFAST® exam is a rapid ultrasound procedure used to detect the presence of free abdominal fluid (which is generally abnormal) as a screening test in order to better direct resuscitation efforts and diagnostics, detect complications, and manage critically ill patients. AFAST® allows rapid but indirect assessment for evidence of major internal abdominal organ injury, disease and complications. The AFAST® exam is not intended to replace a complete abdominal ultrason sound of the abdomen.

5. 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.”

6. The caudal vena cava can be alternatively referred to as a bounce = fluid responsive cava (“35-50% diameter change); FAT = fluid intolerant cava (distended often > 1 cm with no change [<10%]); flat = hypovolemic cava (small often < 5 mm with no change [<10%]).

**References & Further Reading**


6. **Lisciandro GR.** Evaluation of initial and serial combination focused assessment with sonography for trauma (CFAST) examination of the thorax (TFAST) and abdomen (AFAST) with the application of an abdominal fluid scoring system in 49 traumatized cats. *J Vet Emerg Crit Care* 2012;22(2):S11.


