Ultrasound for Abdominal Fluid

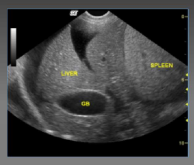
Wendy Blount, DVM

Abdominal Fluid

- US more sensitive than rads for free fluid in abdomen
  - As little as 2 ml/lb detected by US
- It matters where localized fluid lives
  - *Around the gall bladder* – look for signs of cholecystitis
  - *Around the pancreas* – look for signs of pancreatitis
  - *Retroperitoneal* – endocrine/urinary tumors or rupture
  - *Midabdomen* – look for walled off GI perforation
  - *Anywhere/Everywhere* – look for signs of infection, CHF, or source of hemoabdomen/transudate/exudate
- Waving fibrin tags suggests fluid chronicity

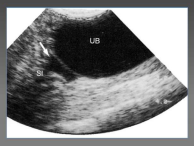
Tips – Abdominal Fluid

- When in dorsal recumbency, the smallest amount of ascites collects between the liver and the diaphragm
- Also look between the liver lobes & kidneys

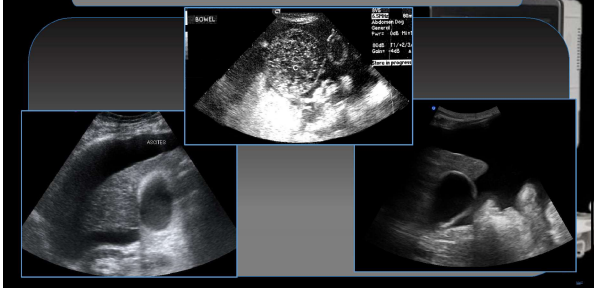


Tips – Abdominal Fluid

- When in dorsal recumbency, the smallest amount of ascites collects between the liver and the diaphragm
- Also look between the liver lobes & kidneys
- And dorsal to the bladder
- When there is a large amount of ascites, all organs appear more hyperechoic
  - US beam is not attenuated by fluid as by soft tissue

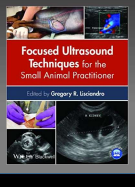


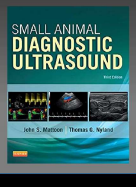
Tips – Abdominal Fluid



AFAST[3]®

- Abdominal Focused ASsessment for Trauma
- T^3 = Trauma, Triage, Tracking





AFAST3®

- Abdominal Focused ASsessment for Trauma
- T3 = Trauma, Triage, Tracking
- Human Medicine 1990s, Validated pets in 2004
- Studied by the Lisciandrios in 2009, and taught since
- www.fastvet.com
- T(horacic) FAST developed by Lisciandros in 2008
- And then VetBLUE lung ultrasound
- Text – "Focused Ultrasound Techniques" ©2014

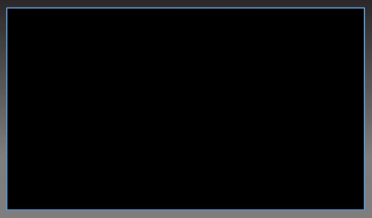
AFAST3®

- 2 hour webinars, day and weekend courses

Academy of Veterinary Imaging
5 minute intro
15 minutes – 4 sites, scoring system

AFAST3®

Academy of Veterinary Imaging GFAST℠ Video



Indications for AFAST3®

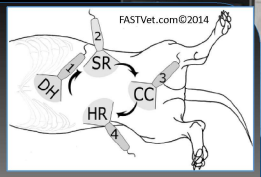
- Abdominal trauma (blunt > penetrating)
- Anaphylactic shock
- Undiagnosed shock, anemia, collapse (acute or chronic)
- Non-traumatic hemoabdomen (including coagulopathy)
- Post percutaneous FNA/biopsy or surgery
- Monitoring for occurrence & progression of hemorrhage or peritonitis
  - Viscus/abscess perforation, ruptured gall bladder, uroabdomen
  - Monitoring open abdomen

Indications for AFAST3®

- Predicts ensuing anemia, need for transfusion, and need for surgery in trauma patients with hemoabdomen
  - 4 hour serial AFAST3® with AFS (sooner if problems)
- During CPR – differentiates low BP from pulseless electrical activity
- Pre-anesthetic screening, geriatric screening
- Screening for systemically ill pet – acute or chronic
  - Choose next best test(s)
- ***DVMs without advanced training can master the technique in a day***

AFAST3® Technique

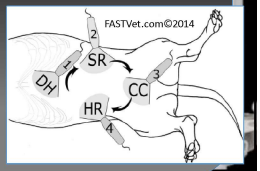
- Right lateral recumbency
- Sagittal probe orientation
  - Probe marker cranial
- No need to clip with high resolution ultrasound
  - Part hairs, alcohol and go
- Use abdominal presets for AFAST3®, TFAST3® and VetBLUE®
- Takes less than 5 minutes for 4 point scan



AFAST³® Technique

Why R lateral recumbency?

- Same position as for ECG & echo
- Avoids cardiovascular compromise
  - Compressed ventilation
  - Compressed venous return
- Reliable GB and L Kidney imaging
  - GI gas out of the way
- Less likely to puncture spleen during Abdominoscentesis
- Dorsal underestimates effusion



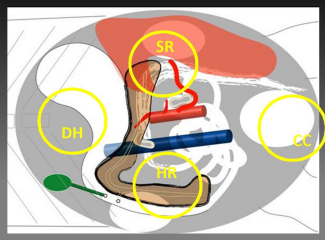
AFAST³® Technique

Why R lateral recumbency?

- Or modified sternal if patient is especially compromised
  - Head & shoulders sternal
  - Rear legs swung to the left

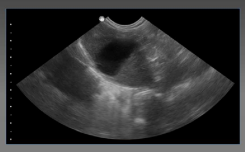
DON'T USE ALCOHOL IF DEFIBRILLATION IS POSSIBLE OR LIKELY

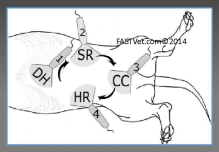
AFAST³® Technique



AFAST³® Technique

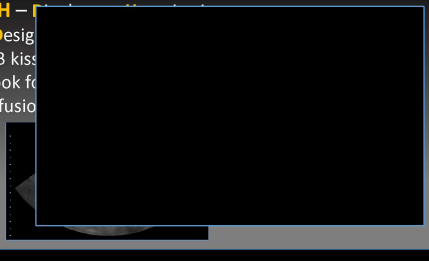
1. **DH** – **D**iaphragm-**H**epatic view
- GB kisses diaphragm (subxyphoid)
- Depth sufficient to see heart & cava





AFAST³® Technique

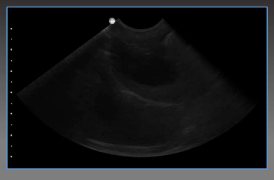
1. **DH** – D
- "Desig
- GB kiss
- Look fo
effusio



AFAST³® Technique

1. **DH**– **D**iaphragm-**H**epatic view

normal

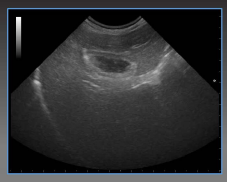


AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view

GB Halo
Thickened gallbladder wall
hypoechoic wall
hyperechoic borders

Not to be confused with anechoic fluid around the gallbladder



AFAST3® Technique

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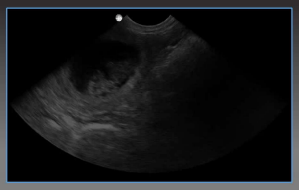


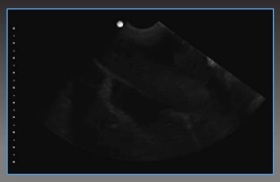
Barton Owens – Henderson TX

AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view

ascites
pleural effusion

histiocytic sarcoma

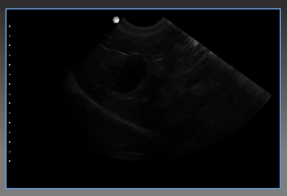


AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view

incidental findings
thickened stomach

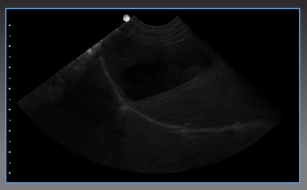
gastric adenocarcinoma



AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view

0-3 ULRS
GB sludge
GB mirror artifact



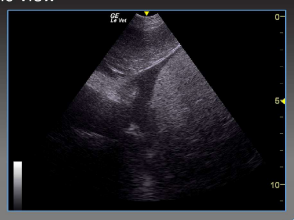
AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view

Ascites
Pericardial Effusion
Pleural Effusion

Hemangiosarcoma
Spleen and RA

AFAST detects 88% of pleural or pericardial effusion

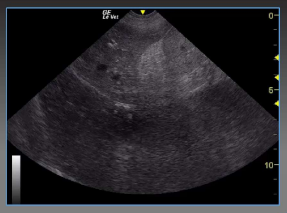


AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view

GB Halo
Ascites
Pericardial Effusion

Pericardial tamponade



AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view

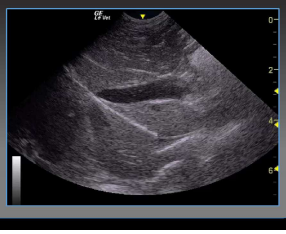
GB Halo
Incidental Finding
Liver Mass

Hemangiosarcoma with pericardial effusion

AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view – Caudal Vena Cava Bounce

- Normal 50% bounce with breathing
- Decreased with passive congestion
- Also Lung Rockets here



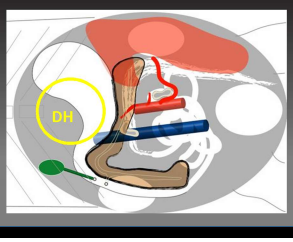
AFAST3® Technique

1. **DH**– **D**iaphragm-**H**epatic view

- Decrease Depth
- Can't see cava or heart

AFAST3® Technique

1. **DH** – **D**iaphragm-**H**epatic view – **REVIEW**

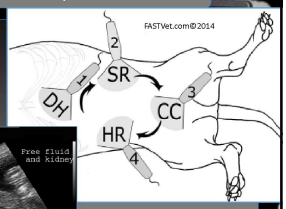


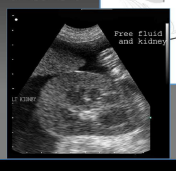
AFAST³® Technique

1. **DH** – **D**iaphragm-**H**epatic view – **REVIEW**
2. Start just caudal to the xyphoid, and angle cranially until you see the gall bladder kissing the diaphragm
   - look for fluid triangles between GB & liver lobes, and for GB Halo
2. Fan toward table (R liver) and away from table (L liver)
   - look for fluid between the liver lobes
3. Rock probe further cranially to pick up the heart
   - look for pericardial fluid, pleural fluid and lung rockets
4. Come back to the gall bladder, and then point probe toward the table to evaluate the caudal vena cava
   - fat, flat, bounce

AFAST³® Technique

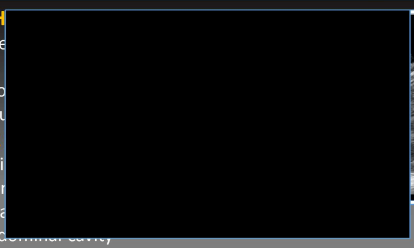
2. **SR** – **S**pleno-**R**enal view
- L kidney identifies left retroperitoneal space
- Head of spleen identifies left abdominal cavity





AFAST³ Technique

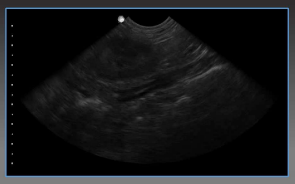
1. **DH**
- "De
- GB
- Loo
effu
2. **SR**
- L ki
retr
- Hea
abd



AFAST³® Technique

2. **SR** – **S**pleno-**R**enal view

normal



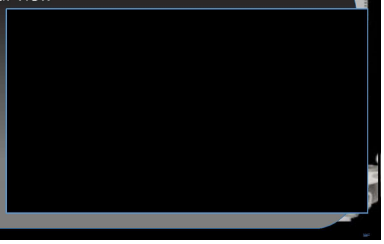
AFAST³® Technique

2. **SR** – **S**pleno-**R**enal view

Retroperitoneal Fluid

Incidental finding
Renal cortical cysts

Can see both kidneys
--cat or small dog

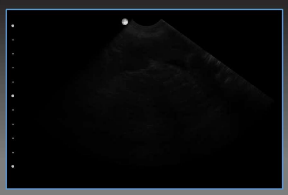


AFAST³® Technique

2. **SR** – **S**pleno-**R**enal view

Abdominal Fluid

Lymphoma of the
Mesenteric lymph node
And GI tract



AFAST³® Technique

2. SR – **S**pleno-**R**enal view

Ascites
Incidental Finding
Mottled liver

Tips – AFAST³®

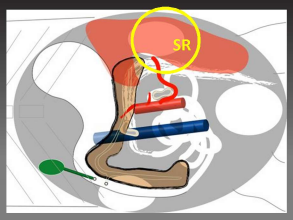
- DH and CC are the most commonly positive for fluid (CC > DH)
- SR is the least sensitive for abdominal fluid
  - Fluid ***triangle*** at the cranial pole of the L kidney is usually abdominal – confirm with positive fluid score elsewhere
  - Fluid ***crescent*** at the cranial and/or caudal pole of the L kidney *without* abdominal fluid confirmed elsewhere is likely retroperitoneal fluid
  - Fluid ***ring*** around the kidney is likely subcapsular
  - Fluid ***line/triangle*** between the L kidney and descending colon is likely abdominal fluid, a dilated ureter, or a great vessel

Tips – AFAST³®

- A small amount of subcapsular renal fluid can be seen with acute renal failure
  - Confirm by looking at the other kidney
- **SR position** - be careful not to push so hard on the probe you push the L kidney out of view
  - Push just hard enough to bring the left kidney into view
- SR view is most sensitive for pneumoperitoneum
- Retroperitoneal fluid can be seen with urinary obstruction, & will resolve w/ resolution of obstruction

AFAST³® Technique

2. SR – **S**pleno-**R**enal view – **REVIEW**

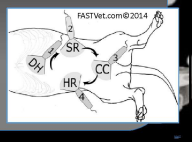


AFAST³® Technique

2. SR – **S**pleno-**R**enal view - **REVIEW**

- Structures seen: fundus of stomach, spleen, L kidney, descending colon

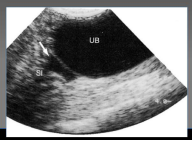
1. Start at the tomato view of the L kidney, just caudal to the ribs
2. Fan L kidney medial to lateral
3. Rock probe cranial to look at spleen and fluid – stop at the stomach
4. Point the probe to the mid-abdomen for final interrogation for fluid

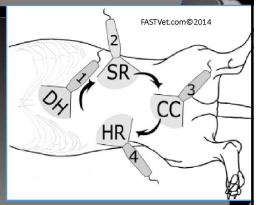


AFAST³® Technique

3. CC – **C**ysto-**C**olic view

- Retroperitoneal sublumbar space
- Caudal abdominal cavity
- Bladder kisses abdominal wall





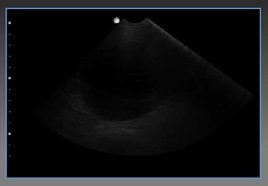
AFAST³ Technique

3. **CC**
- Ret
- Cau

AFAST³® Technique

3. **CC** – Cysto-Colic view –

normal

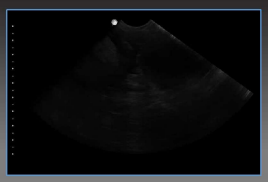


AFAST³ Technique

3. **CC** – Cysto-Colic view –

Small Volume Effusion
Thickened omentum

Abdominal multicentric lymphoma



AFAST³ Technique

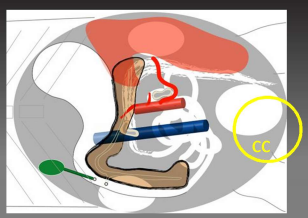
3. **CC** – Cysto-Colic view –

Incidental Finding
Spleen Mass

hematoma

AFAST³® Technique

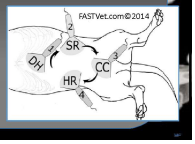
3. **CC** – Cysto-Colic view – **REVIEW**



AFAST³® Technique

3. **CC** – Cysto-Colic view - **REVIEW**

1. Place the probe sagittally over the bladder, pointing down toward the table – bladder kisses the abdominal wall (CC pouch)
2. Fan through the bladder toward the table and away, looking for black fluid triangles and checking integrity of the bladder
3. Pause where you see the bladder kissing the body wall, and wait for about 30 seconds for fluid to pool there



Ann Holland – Port Arthur, TX

AFAST[3®] Technique

Fosgate Formula to estimate bladder volume

- Bladder volume should increase in response to IV fluid resuscitation, if the urinary bladder is intact

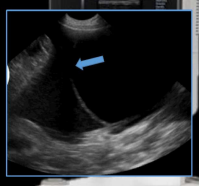
Bladder length x width x height (cm) x 0.63 = urine volume (ml)

Tips – AFAST[3®] - CC

- Don't sweat it if you can't find the urinary bladder on the first serial AFAST[3]
  - Recheck at 4-hour AFAST[3] – ***slide ventrally*** to avoid colon
  - no bladder after 4 hrs of fluids means either oliguric/anuric renal failure, or ruptured urinary tract
  - Look for retroperitoneal and/or free abdominal fluid to confirm

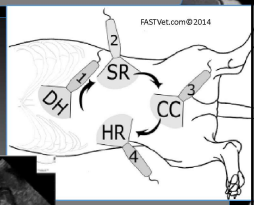
Pitfalls – AFAST[3®] - CC

- Air filled colon can obscure CC
  - Reposition more ventrally
- Beware of the edge shadow artifact in the CC position
  - Bladder wall parallel to the ultrasound beam will drop out
  - Don't mistake for a ruptured bladder
  - ***Significantly ruptured bladder will not be round and large***

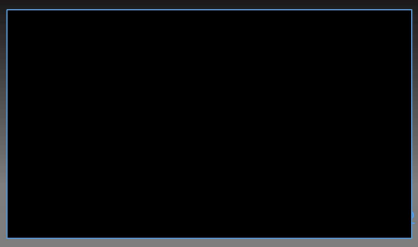


AFAST[3®] Technique

4. **HR** – **H**epato-**R**enal Umbilical view
- "**H**ome **R**un" view
  - finishes AFAST[®3] & gets fluid
- Right kidney identifies right peritoneal space
- Abdominocentesis here



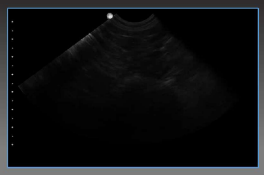
AFAST[3®] Technique



AFAST3® Technique

4. HR – Hepato-Renal Umbilical view

normal



AFAST3 Technique

4. HR – Hepato-Renal Umbilical view

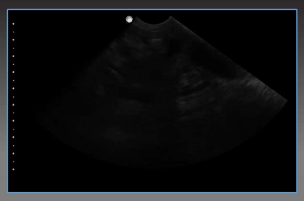
Ascites

AFAST3 Technique

4. HR – Hepato-Renal Umbilical view

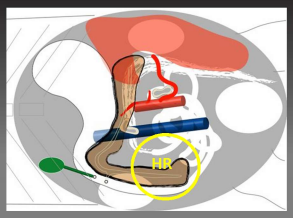
Ascites
Thickened omentum

Histiocytic Sarcoma



AFAST3® Technique

4. HR – Hepato-Renal view – REVIEW



AFAST3® Technique

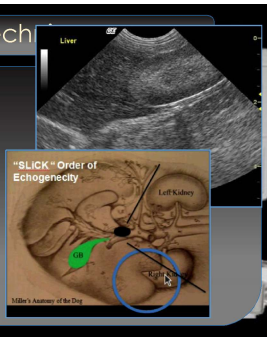
4. HR – Hepato-Renal Umbilical view – REVIEW

1. Place the probe sagittally between the umbilicus and the table
2. Fan toward and away from the table, looking for free fluid in the abdomen
3. To tap the fluid:
   - Locate black fluid triangle with the probe
   - Pass a 22g – 1-1/2 inch needle into the fluid
   - Catch the fluid by free flow into a red top and a purple top

AFAST3® Tech

5. HR2 – 2nd Hepato-Renal view (5th AFAST View)

- For Advanced Abdominal FAST
- Look for retroperitoneal fluid
- If abdominal fluid seen, not part of AFS
- Do if renal or bladder pathology, or hematuria



AFAST3® Technique

Abdominal Fluid Scoring (AFS) system (score 0-4)

- Assign 1 point for abdominal fluid (>4mm) at each of the 4 check points (retroperitoneal fluid does not count)
  - <4-5mm is 0.5 point or "soft" positive
- **AFS 1-2** – small bleeder – rarely become anemic
- **AFS 3-4** – big bleeder – always becomes anemic (if blood)
- **Increasing AFS** = progressive bleeding or effusion
- **Decreasing AFS** = resolution of bleeding or effusion
- ***Caveat:*** must sample fluid to confirm that it is blood

AFAST3® Technique

AFS 3-4 – big bleeder after trauma

- More likely to need transfusion (20-25%) or surgery (5%)
- More likely to have pneumothorax, pelvic fracture , high ALT
  - These are triggers for the AFAST®3 exam
  - 40% of dogs with pelvic fractures have hemoabdomen
  - HBC patients (Lisciandro, 2014):
    - ALT >1000 U/L has 90% specificity for hemoabdomen
    - ALT <100 U/L has 90% sensitivity for no hemoabdomen
  - 55% of dogs w/ traumatic pneumothorax have hemoabdomen

AFAST3® Technique

AFS 3-4 – big bleeder after trauma

- Indicates need for graduated fluid therapy titrated to more conservative end points
  - Prevents "popping the clot," resulting in re-bleeding
  - Resuscitate until caval bounce returns (more accurate than CVP)
- Cage confinement until bleeding resolves is indicated

•AFAST®3 makes diagnostic peritoneal lavage mostly obsolete

AFAST3 Technique

Post-Surgical or US Guided Sampling AFS

- Increasing AFS after surgery/biopsy with propensity to leak or bleed may indicate peritonitis or hemorrhage
  - Get fluid for assessment
  - Liver surgery or biopsy (bleeding)
  - GB surgery/FNA (leaking)
  - GI surgery (dehiscence 3-5 days later) or pyometra
  - Some urinary tract surgeries, rarely cystocentesis or urinary catheterization (uroabdomen)
- ***Keep patients 4 hrs after liver/spleen FNA for AFAST®3 prior to release***

Tips – AFAST3® - AFS

- Don't sweat tiny triangles of fluid
  - Recheck with the next serial AFAST3
  - Every 4 hours, or sooner if patient condition worsens
- ***AFS 3-4 after surgery (confirmed hemorrhage) should generally be explored***
  - Clean your gutters after surgery!
- Ascites in cats surviving HBC more likely urine than blood
- Cats with spontaneous non-traumatic hemoabdomen have a poor prognosis
- 95% of free abdominal fluid in HBC dogs is blood
  - <2-3% uroabdomen

Tips – AFAST3® - AFS

- ***Crump Factor***
  - Most common cause of death in human trauma cases is undetected hemorrhage
  - The most sensitive way to detect it is serial AFAST®3
- First bleeding at DH site
  - Bleeding from liver, vena cava, hepatic vein
- First bleeding at more caudal site
  - Bleeding from spleen, mesenteric vessel, etc.

Tips – AFAST[3®] - AFS

- AFAST[3®] statistics (Lisciandro) are emergency patients
- Abdominal fluid is most often blood or urine in trauma cases
- Abdominal fluid in the chronically ill patient is most often a modified transudate
  - CHF and neoplasia are most common
  - Exception in cats – FIP exudate or chylothorax
- Exudates more likely in the acutely ill (non-traumatic)
  - Septic exudate – ruptured GI, repro or abscess
  - Sterile suppurative exudate – pancreatitis
  - Bile or urine peritonitis – ruptured biliary or urinary tract

Tips – AFAST[3®] - AFS

- Transudates not common, but if they happen, they are usually chronic
  - Portal hypertension, hypoalbuminemia
- Always spin down fluid that appears to be blood, and compare to peripheral PCV
  - PC<10% can look like blood, but is usually serosanguinous

Fluid Analysis Chart

Tips – AFAST[3] - AFS

Tips from the Fluid Analysis Chart

- >5,000/ul WBC, TP > 3 g/dl = exudate
- Look inside the neutrophils and macrophages for bacteria
- Large numbers of bacteria – usually surgical
- Compare ascitic fluid to plasma/serum
  - *Bili* – fluid >> serum – bile peritonitis
  - *Creat* – fluid >> serum – uroabdomen
  - *Triglycerides* – fluid >> serum; *Cholesterol* fluid << serum – chyle
  - *Albumin* – serum >> fluid – transudate
  - *Glucose* – fluid << serum - exudate

Tips – AFAST[3] - AFS

FIP – Wet Form

- Cavity Fluid
  - Straw colored to yellow – forms mucus strings
  - High Protein (>3.5, often 5-12) & relatively low cells (5-10K/ul)
  - A:G ratio usually <0.8, A:G <0.45 strong evidence
  - Mononuclear cells > nondegenerate neutrophils with chronicity
- Patient Blood Parameters
  1. Coronavirus titer >1:160
  2. Blood Lymphocytes <1500/ul
  3. Serum Globulins >5.1 g/dl
  - PPV all three positive 89%, NPV all three negative 99%

Pitfalls – AFAST[®3] - AFS

- Loss of serosal detail on abdominal rads has poor sensitivity and specificity for hemoabdomen
  - 24% of HBC dogs with normal serosal detail were positive for fluid on AFAST AFS
  - 33% of HBC dogs with abnormal serosal detail on rads were negative for fluid on AFAST AFS

Pitfalls – AFAST[3] - AFS

- Great vessels can be confused with abdominal fluid, especially at the SR view
  - Great vessels are tubular, and fluid is angular (often triangular)
  - Rotate the probe – vessels will elongate from round to a tube
  - Look for the pulse of the aorta & large arteries
  - Put some color Doppler on it
- Hydroureter can look like retroperitoneal fluid
  - look for ureter walls

Pitfalls – AFAST^{3} - AFS

- AFAST$^{3®}$ is less sensitive for penetrating trauma than for blunt trauma (specificity is good – few false positives)
  - ***Clotted blood is more likely with penetrating trauma, and it resembles soft tissue*** (you can miss bleeding)
  - Serial AFAST^{3} exams increases sensitivity
  - Penetrating trauma AFS 3-4, you should generally explore
  - Abdominal rads are more diagnostic for penetrating trauma than for blunt trauma

AFAST$^{3®}$ Anaphylaxis

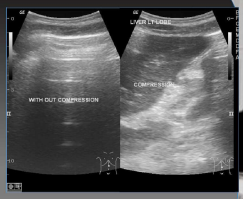
- ***AFAST^{3} for anaphylaxis***
  - 5 signs - Passive liver congestion, gall bladder edema without pericardial effusion, hemoabdomen, elevated ALT, elevated aPTT
  - GB edema within 2-4 minutes & resolves in 24-48 hours
  - Elevated ALT within 2-4 hrs
  - Elevated aPTT and hemoabdomen are possible
- Treatment
  - IV fluids, epinephrine, antihistamines, corticosteroids
  - AFS 3-4 can occur – surgery is usually deadly – give plasma or blood instead

Pitfalls – AFAST$^{®3}$ - Anaphylaxis

- Assess for anaphylaxis before cutting AFS 3-4 hemoabdomen
  - History – went outside or exposed to known/likely allergen prior to collapse
  - AFAST$^{®3}$ pattern – 5 signs
  - Exam – weak pulses, pale mm, slow CRT, abdominal pain
  - Response to therapy – rapid recovery within the hour

Pneumoperitoneum

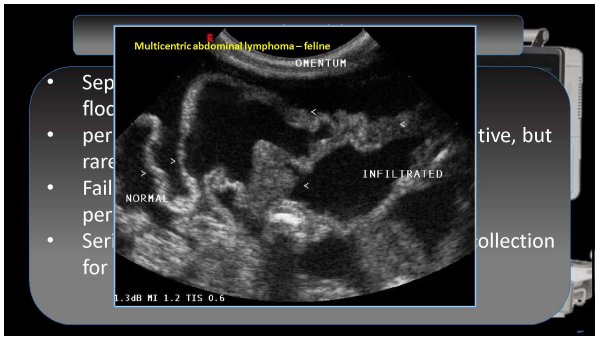
- Expected for a few days after surgery – can hinder post-op sonograms
- If no previous surgery, considered to be a surgical emergency
- Ruptured hollow abdominal viscus is the most likely cause
- SR (costophrenic angle) most sensitive for small amts of gas

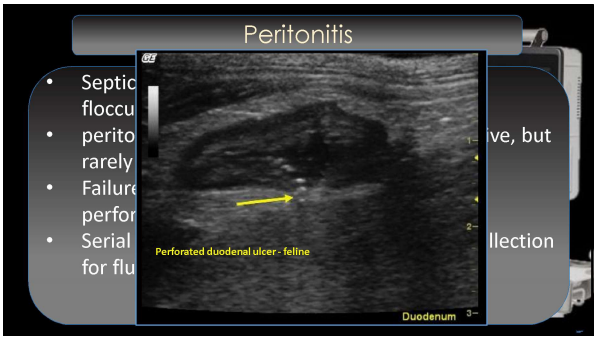


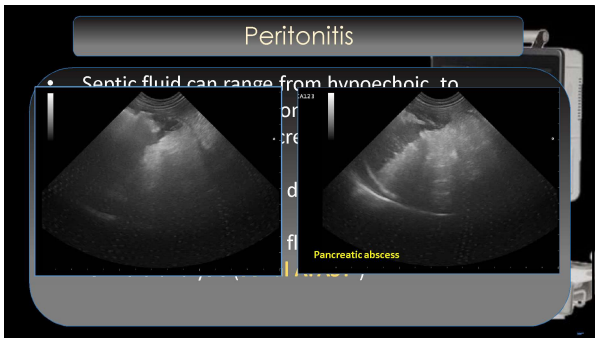
Kaitlyn Boerner – Commerce TX

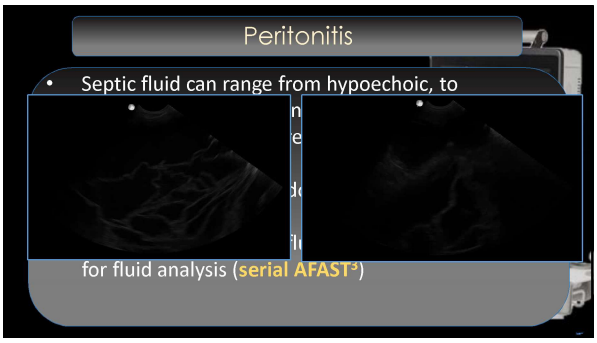
Peritonitis

- Septic fluid can range from hypoechoic, to flocculent, to swirling on sonogram
- peritonitis due to pancreatitis often suppurative, but rarely septic
- Failure to find free gas does not rule out GI perforation
- Serial accumulation of fluid should prompt collection for fluid analysis (**serial AFAST^{3}**)


Multicentric abdominal lymphoma – feline
OMENTUM
INFILTRATED
NORMAL
1.3dB MI 1.2 TIS 0.6


Peritonitis
Perforated duodenal ulcer - feline
Duodenum


Peritonitis
Pancreatic abscess


Peritonitis
Septic fluid can range from hypoechoic, to
for fluid analysis (serial AFAST³)


Summary
•PowerPoint - Ultrasound of the Peritoneum
•.pdf of PowerPoint - Ultrasound of the Peritoneum (1 and 6 slides per page)
•Article: Lisciandro - AFAST
•Vet Handouts: Fluid Analysis Chart, AFAST Protocol Quick Guide,
•Video: http://education.soundeklin.com/ (requires set-up of free account)
AFAST Videos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