WEBINAR

Veterinary POCUS: Assessing Acute Abdominal Conditions Using the Rapid 5-Point Abdominal POCUS Exam

July 2022

clarius

Your Host

Dr. Oron Frenkel, MD, MS

Emergency Physician & POCUS Educator

Chairman, Clarius Medical Advisory Board

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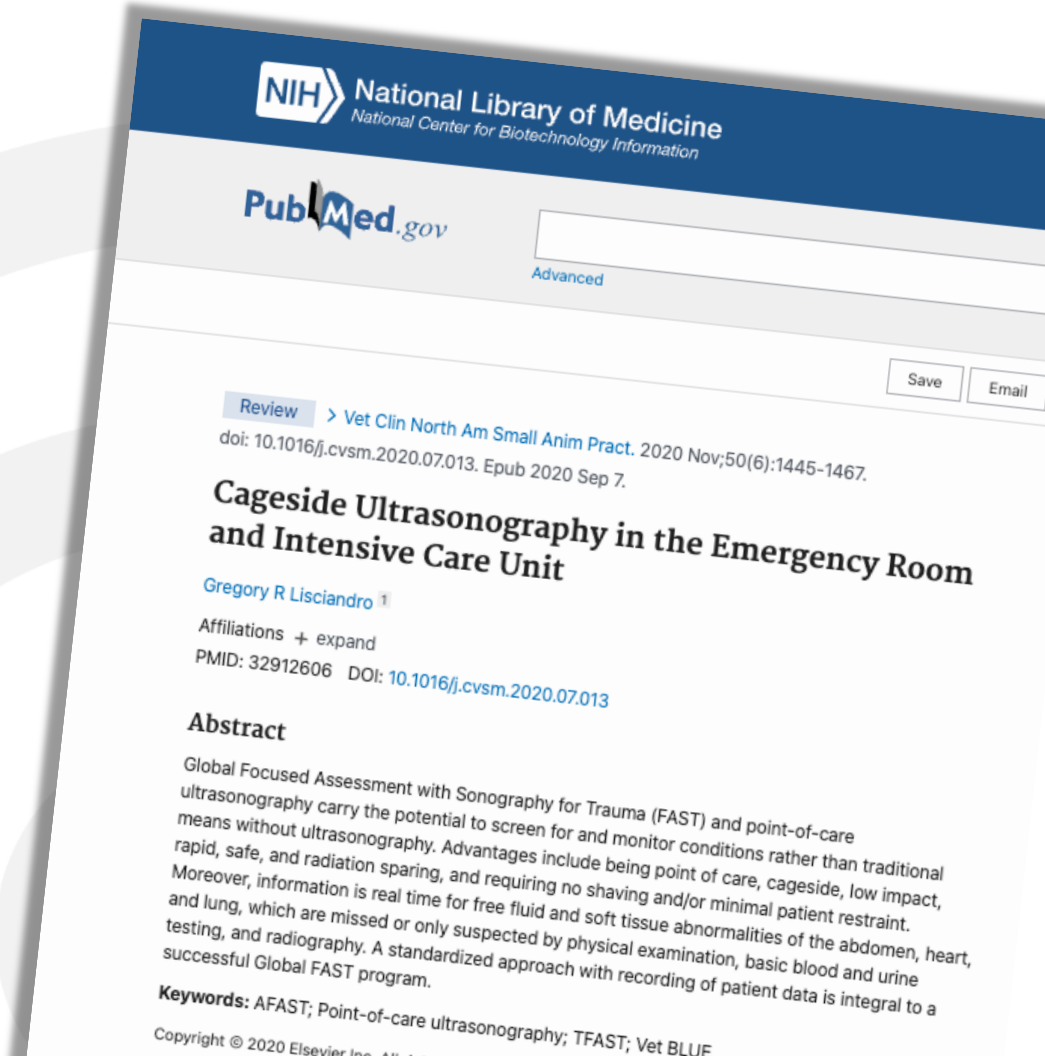
Cageside Ultrasonography in the Emergency Room and Intensive Care Unit

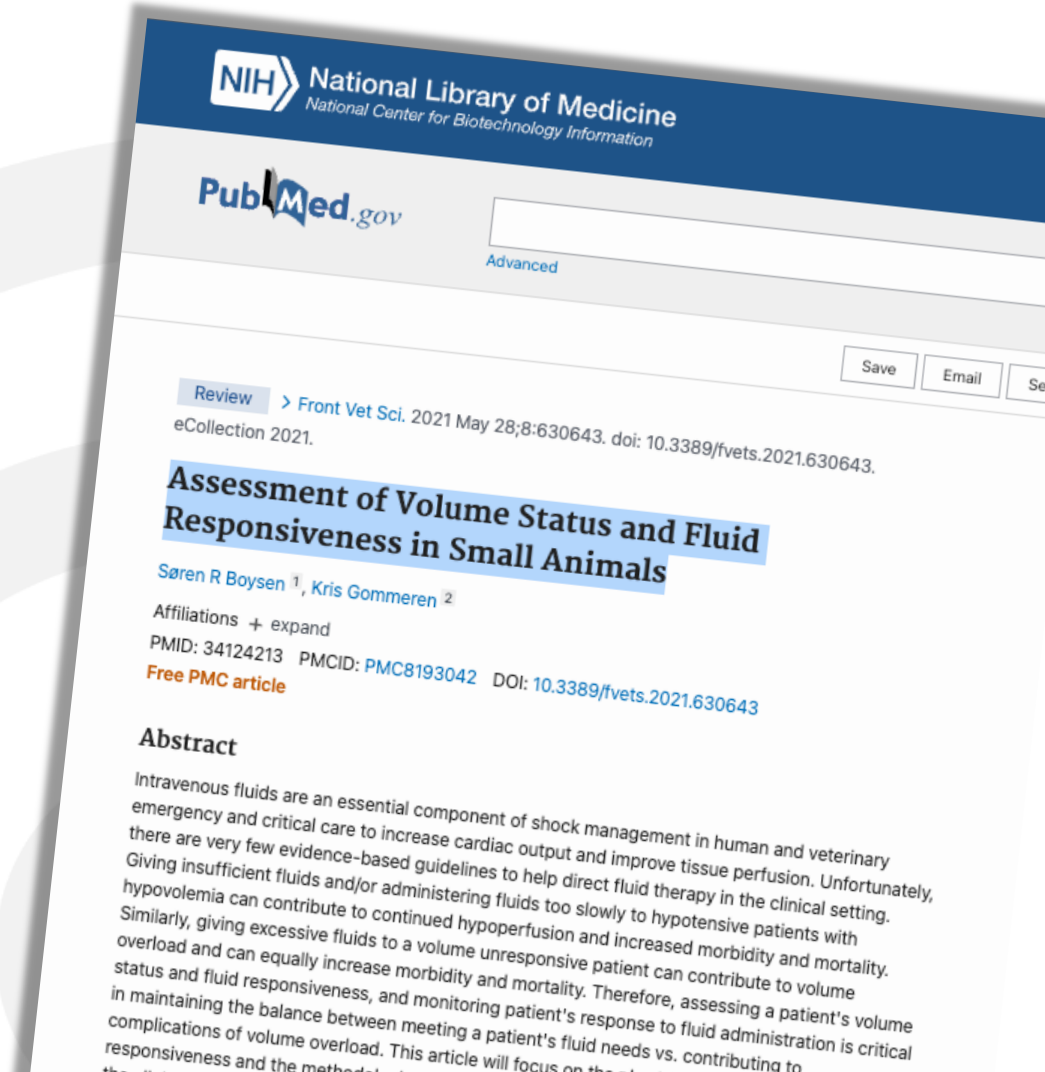
Information is real time for free fluid and soft tissue abnormalities of the abdomen, heart, and lung, which are missed or only suspected by physical examination, basic blood and urine testing, and radiography



Lisciandro GR. Cageside Ultrasonography in the Emergency Room and Intensive Care Unit. Vet Clin North Am Small Anim Pract. 2020 Nov;50(6):1445-1467. doi: 10.1016/j.cvsm.2020.07.013. Epub 2020 Sep 7. PMID: 32912606.

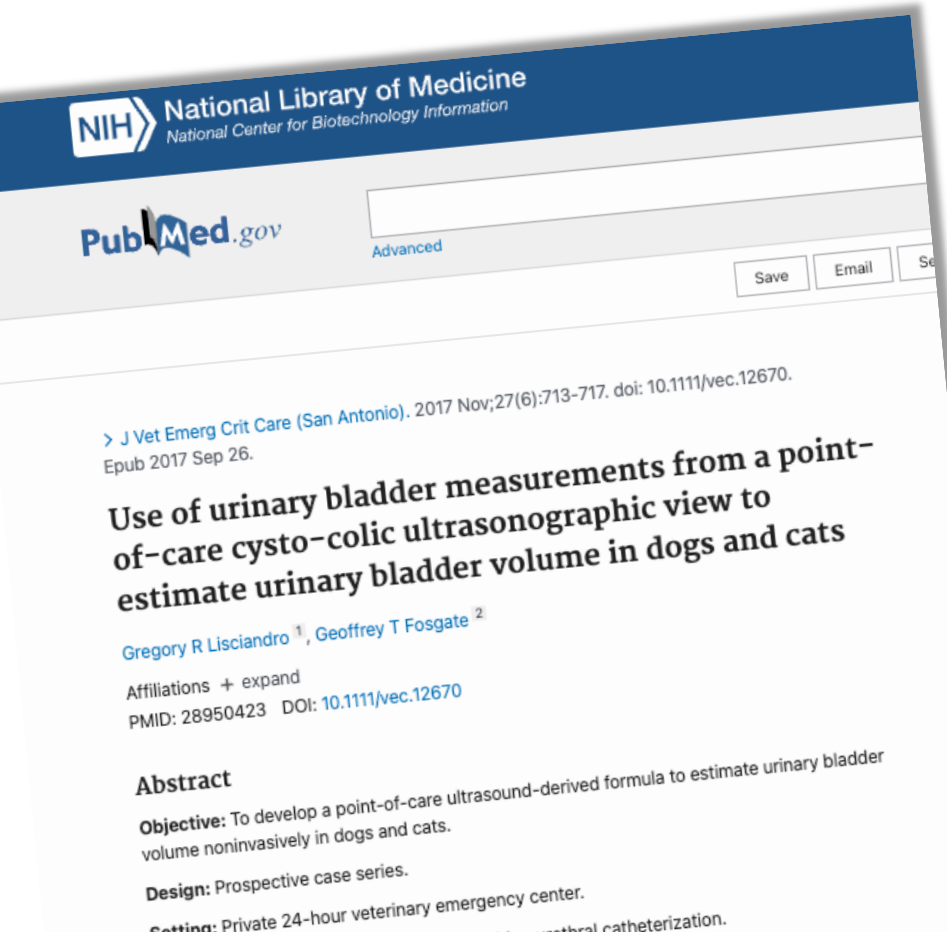
Assessment of Volume Status and Fluid Responsiveness in Small Animals

Assessing a patient's volume status and fluid responsiveness, and monitoring patient's response to fluid administration is critical in maintaining the balance between meeting a patient's fluid needs vs. contributing to complications of volume overload.



Boysen SR, Gommeren K. Assessment of Volume Status and Fluid Responsiveness in Small Animals. Front Vet Sci. 2021 May 28;8:630643. doi: 10.3389/fvets.2021.630643. PMID: 34124213; PMCID: PMC8193042.

Use of urinary bladder measurements from a point-of-care cysto-colic ultrasonographic view to estimate urinary bladder volume



The point-of-care ultrasound-derived formula may be useful to estimate urine volume noninvasively in dogs and cats.

Lisciandro GR, Fosgate GT. Use of urinary bladder measurements from a point-of-care cysto-colic ultrasonographic view to estimate urinary bladder volume in dogs and cats. J Vet Emerg Crit Care (San Antonio). 2017 Nov;27(6):713-717. doi: 10.1111/vec.12670. Epub 2017 Sep 26. PMID: 28950423.

Your Expert Guest Speakers

Dr. Soren Boysen, DVM, DACVECC
Professor, Veterinary Clinical & Diagnostic Sciences, University of Calgary

Dr. Serge Chalhoub, BSc, DVM, DACVIM
Senior Instructor, Veterinary Clinical & Diagnostic Sciences, University of Calgary

clarius Ultrasound Anywhere

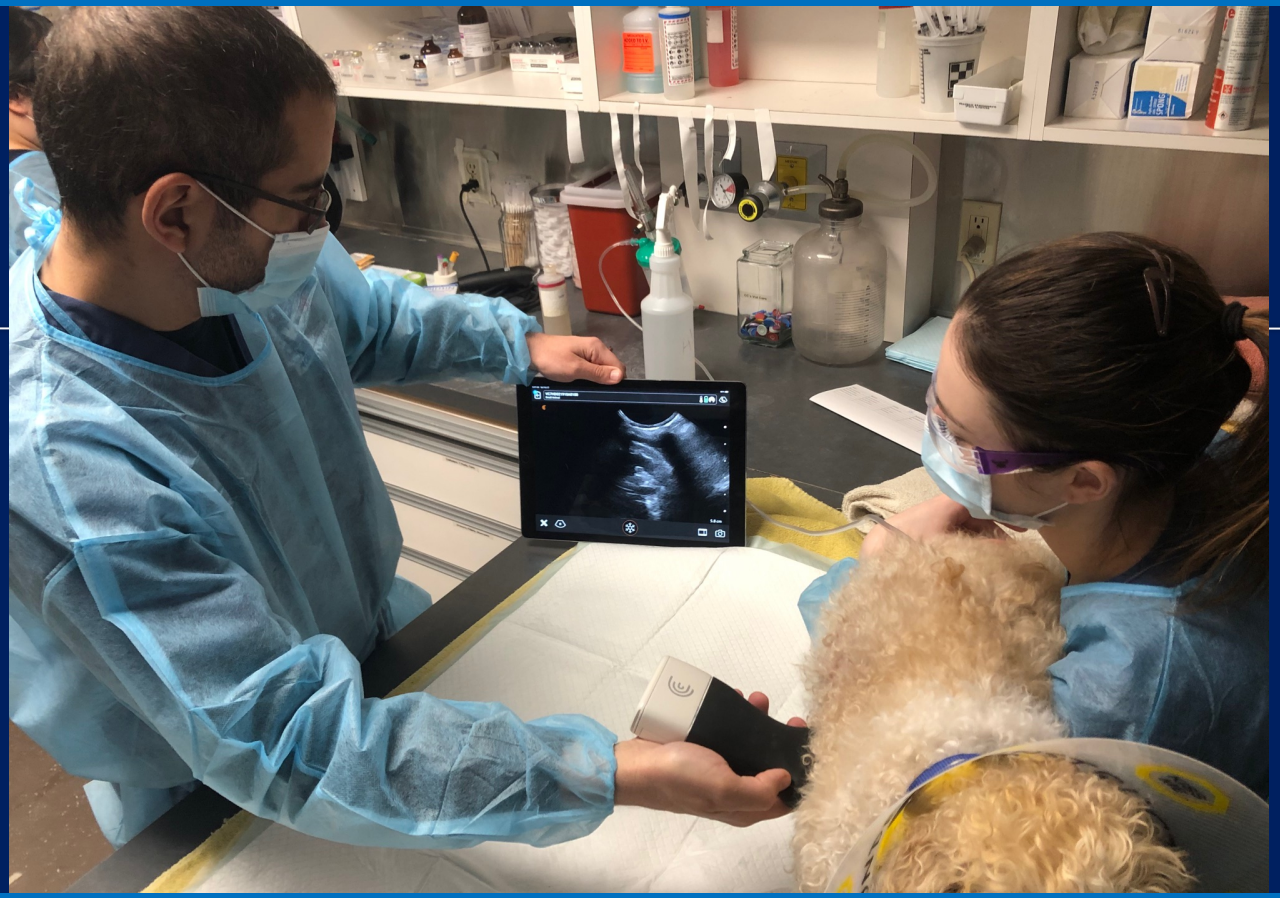
Veterinary POCUS: Rapidly assessing acute abdominal conditions using the 5-point abdominal point-of-care ultrasound (POCUS) exam

UNIVERSITY OF CALGARY VETERINARY MEDICINE

Søren Boysen, DVM, DACVECC

srboysen@ucalgary.ca

Veterinary Clinical and Diagnostic Sciences



UNIVERSITY OF CALGARY VETERINARY MEDICINE

Serge Chalhoub, DVM, DACVIM

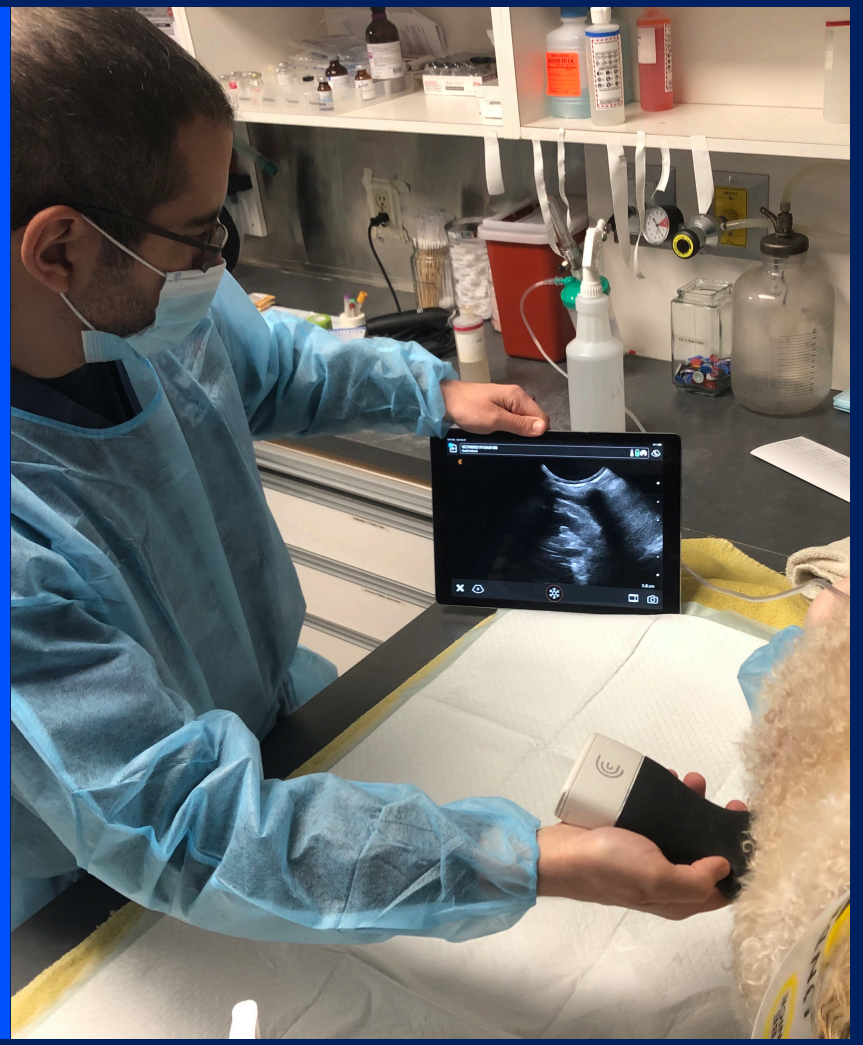
schalhou@ucalgary.ca

Veterinary Clinical and Diagnostic Sciences

In relation to this presentation, we receive conference honorariums, but otherwise declare no conflicts of interest

Objectives for today

- Discuss how POCUS is applied based on the clinical setting encountered
- Review current specific abdominal POCUS applications
- Demonstrate how the 5-point abdominal POCUS exam is performed
- Demonstrate the application of POCUS in a patient with an acute abdomen



Zola: History and presenting complaint

- 3-year-old m/n Husky
- Cried out after landing on the tailgate trying to jump out of a truck 48 hours ago
- Seemed fine afterwards
- Vomiting this morning, not eating past 24 hours
- Does not want to get up or walk

Zola

Zola: Physical exam

- Very dull but responsive, estimated weight 30 kg
- HR: 160 bpm, RR: 20 breaths per minute, T: 37.1 C (98.8 F)
- Is ambulatory but does not want to walk
- Very painful (tries to bite) when palpating the abdomen

Stable or unstable?

Is POCUS indicated?

POCUS and unstable patients……

Are all aspects of POCUS always indicated in all patients?

- Prevalence of free fluid (any cavity with POCUS)
  - Stable patients (based on triage exam): < 10% chance of free fluid
  - Unstable patients (based on triage exam): ≥ 75% chance of free fluid
- No significant difference in prevalence of free fluid between dogs and cats

JOURNAL OF Veterinary Emergency AND Critical Care

Original Study

Journal of Veterinary Emergency and Critical Care **26**(1) 2016, pp 64–73
doi: 10.1111/vec.12376

Focused assessment with sonography in nontraumatized dogs and cats in the emergency and critical care setting

Jantina McMurray, DVM; Søren Boysen, DVM, DACVECC and Serge Chalhoub, DVM, DACVIM

Serious conditions result in sonographically detectable findings!

POCUS is an extension of the physical exam…..

- As such POCUS should be applied similarly to the physical exam…
  - Is a full cranial nerve examination indicated on every patient?
  - Is a full orthopedic exam always indicated?
  - Do you do a rectal exam on really dyspneic patients?

All aspects of POCUS are not always indicated

How is POCUS clinically applied?

General Application of POCUS?

1. Abdominal POCUS
2. Pleural space & lung ultrasound (PLUS)
3. Cardiac POCUS
4. Other techniques developed as research expands
   - Nerve blocks, optic nerve sheath diameter, etc.

How is it used?

Patient centered & targeted!

Abdominal POCUS	Pleural and lung POCUS	Cardiovascular POCUS

Patient assessment & pretest probabilities

Patient

Journal of HOSPITAL M

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Observational/Cohort Study — Critical Care Explorations

Impact of Point-of-Care Ultrasound in the Emergency Department on Care Processes and Outcomes in Critically Ill Nontraumatic Patients

Jarrod M. Mosier, MD FCCM[1,2,3]; Uwe Stolz, PhD, MPH[4]; Rebecca Milligan, MD[1,2,3]; *Crit Care Expl 2019; 1:e0019*

J Korean Med Sci. 2020 Feb 24;35(7):e54
https://doi.org/10.3346/jkms.2020.35.e54
eISSN 1598-6357·pISSN 1011-8934

JKMS

Special Article
Medicine General & Policy

Check for updates

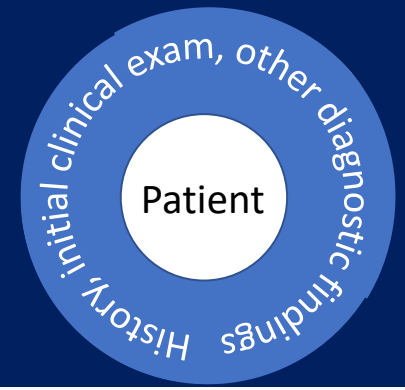
Clinical Guidance for Point-of-Care Ultrasound in the Emergency and Critical Care Areas after Implementing

Evidence suggests POCUS may delay treatment and adversely affect outcomes in some ER cases

Patient centered & targeted!

Abdominal POCUS	Pleural and lung POCUS	Cardiovascular POCUS

Patient assessment & pretest probabilities



shm Journal of HOSPITAL MEDICINE www.journalofhospitalmedicine.com

REVIEWS

Diagnostic Point-of-Care Ultrasound for Hospitalists

Nilam J. Soni, MD[1]*, Brian P. Lucas, MD, MS[2]

[1]Department of Medicine, University of Texas Health Science Center, San Antonio, Texas; [2]Medicine Service, VA Medical Center, White River Junction, Vermont.

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JKMS

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Medicine General & Policy

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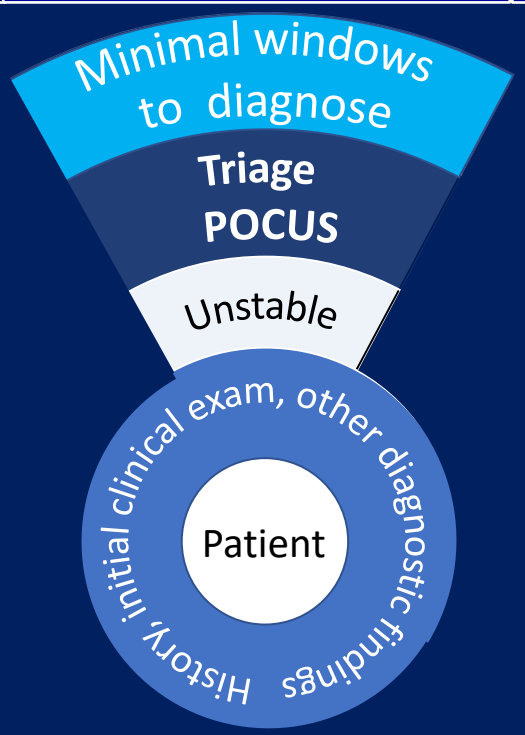
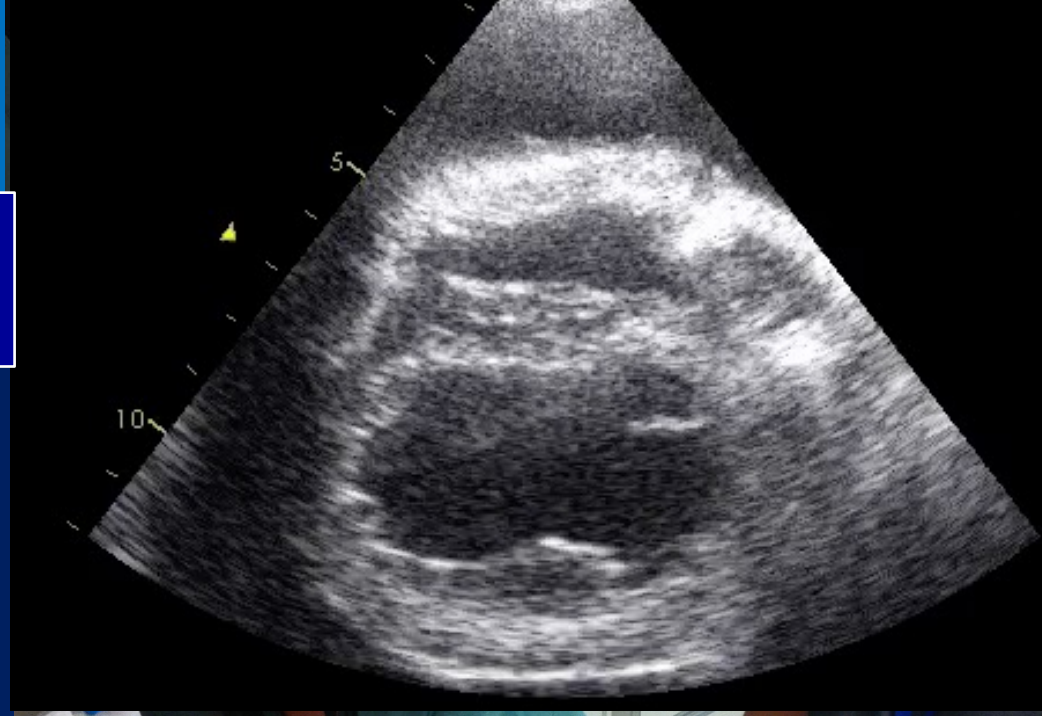
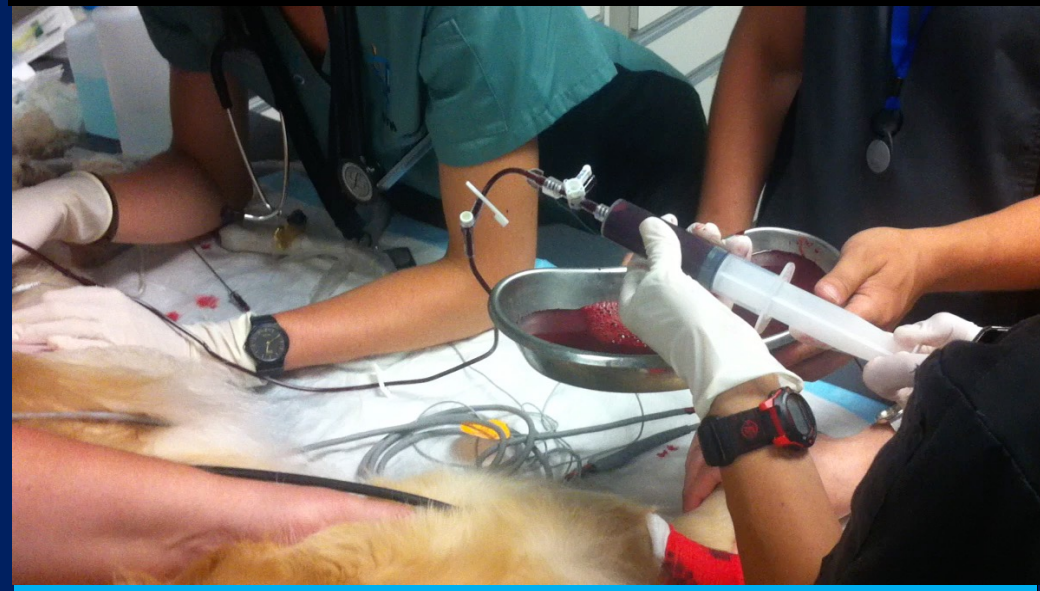
Clinical Guidance for Point-of-Care Ultrasound in the Emergency and Critical Care Areas after Implementing Insurance Coverage in Korea

Patient centered & targeted!

Abdominal POCUS	Pleural and lung POCUS	Cardiovascular POCUS

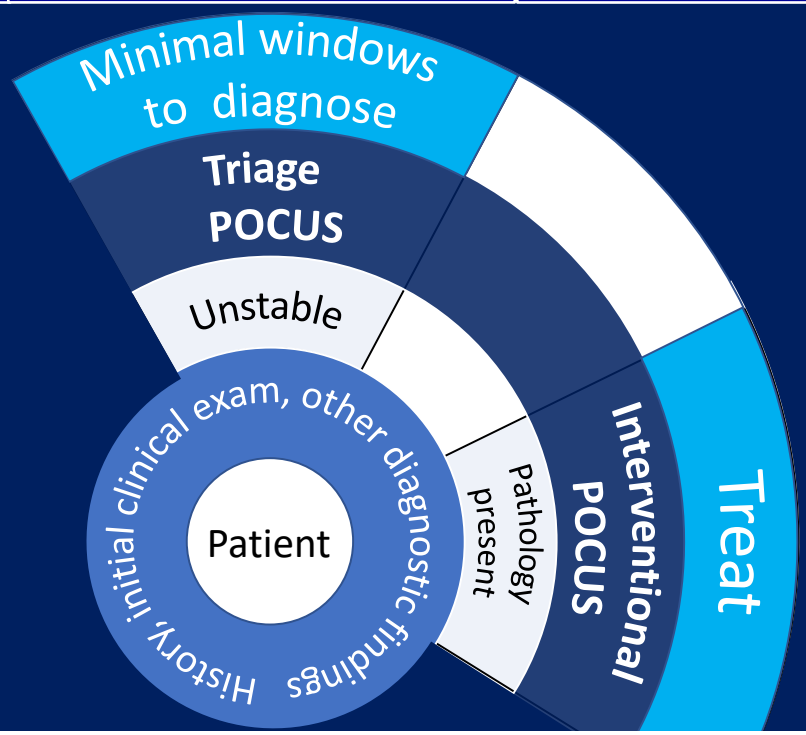






Patient centered & targeted!

Abdominal POCUS	Pleural and lung POCUS	Cardiovascular POCUS



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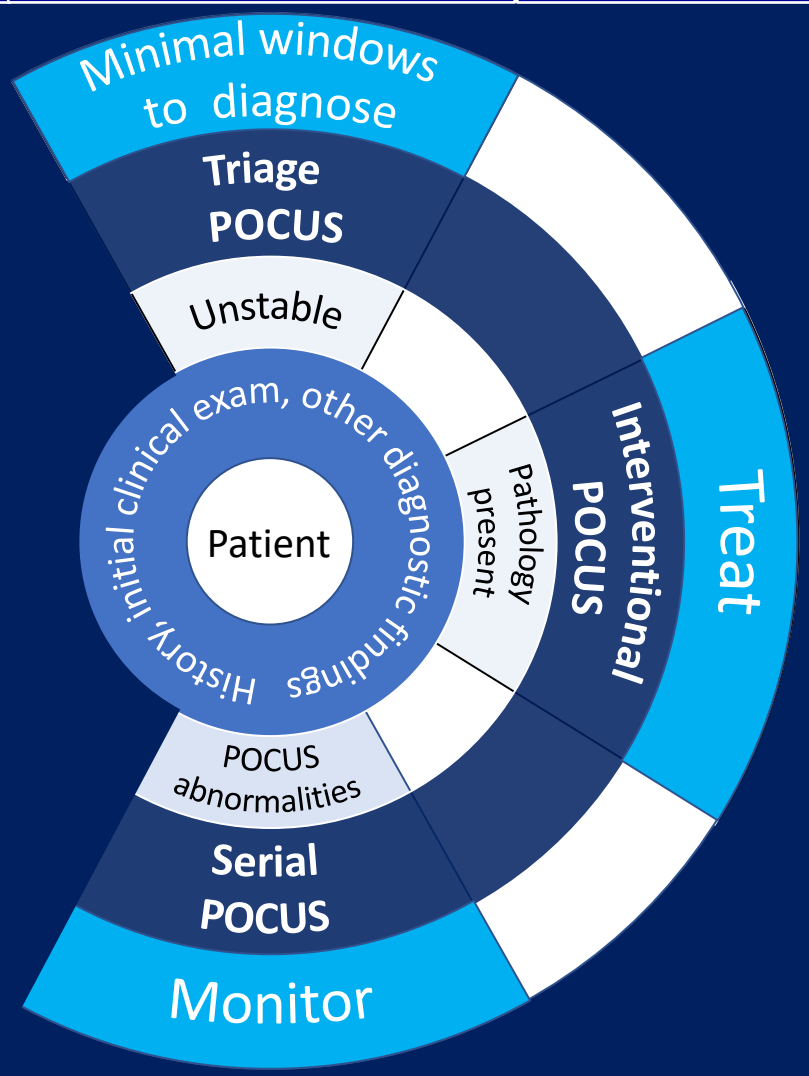
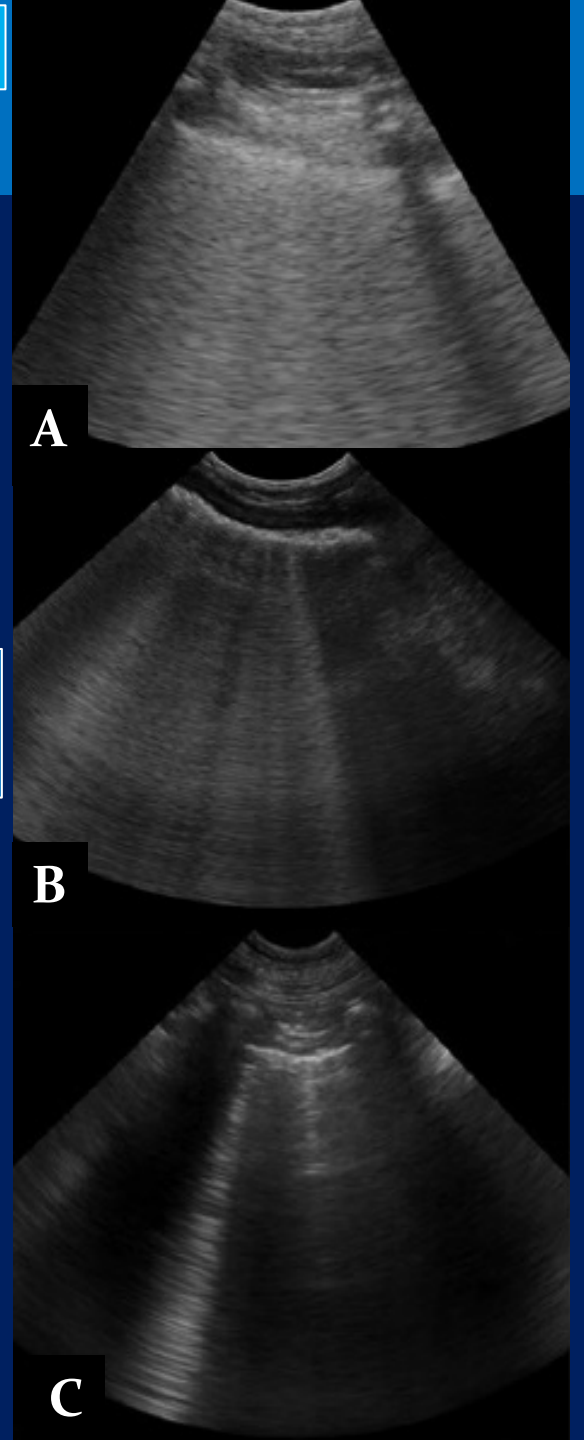


Furosemide

Decreasing severity



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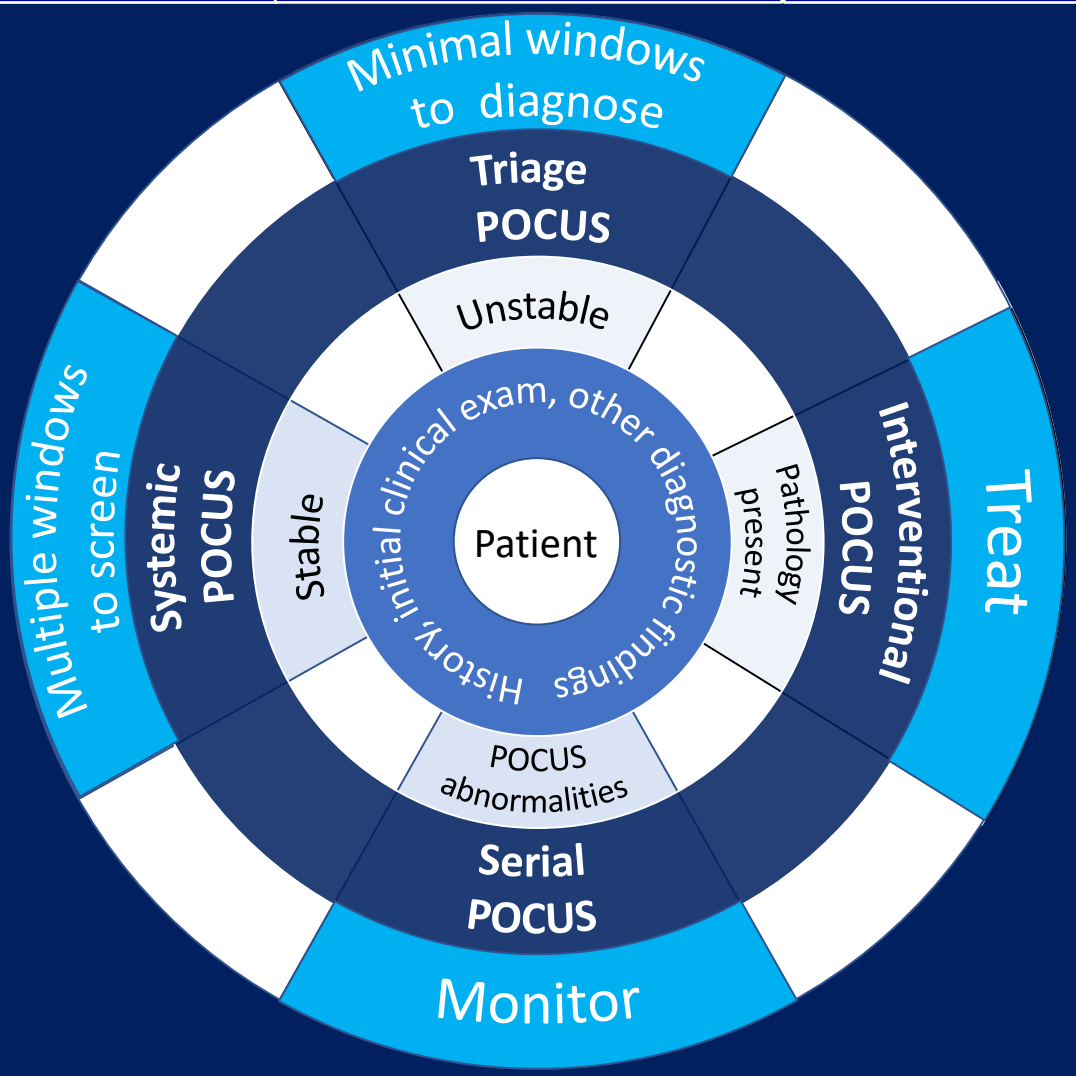

Pre and post surgery or prior to discharge

General and ICU hospitalized

POCUS: General concepts

- Probe selection, frequency, depth?
- To clip or not to clip?
- Coupling agents?
  - Alcohol
  - Alcohol/gel mixes
  - Alcohol on the dog, gel on the probe

Microconvex/curvilinear
5-8 MHz

Coming back to Zola…

Do you currently want to scan and answer all possible POCUS questions?

What POCUS question(s) (binary) do you want to rule in/out considering the clinical information?

HR: 160, RR: 20 breaths per minute, T: 37.1 C (98.8 F)

- PCV 49% (37-55)
- TS 55 g/L (60-78)
- BUN >80 mg/dl (15-26)
- Glu 10 mmol/L (4-6.5) (180 mg/dl)
- Lac 8.3 mmol/L (<2.5)
- Doppler systolic blood pressure: 78 mmHg

Differential diagnoses?

- Could be many things …..
  - Hemoabdomen (ruptured mass, trauma or both)
  - Uroabdomen (trauma induced)
  - Bile peritonitis (trauma induced)
  - Referred pain - Disc disease/fracture
  - Trauma (tail gate injury) is a ”red herring”
    - Other acute abdominal condition (e.g. GI foreign body, pancreatitis, other)
    - Other cause of shock (e.g. pericardial effusion)

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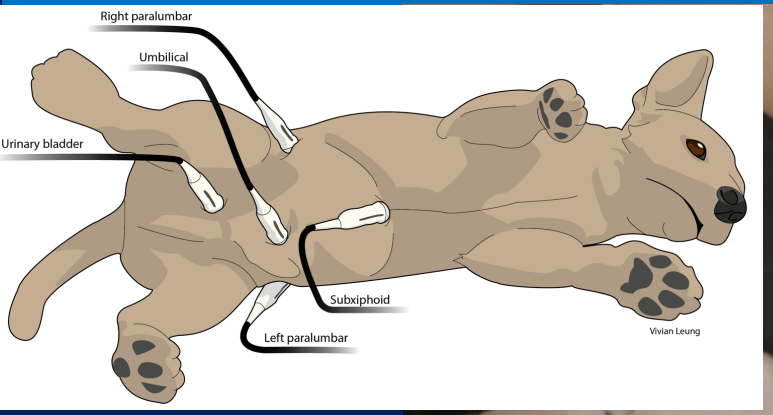
1. What system and question(s)are you going to start with?
2. What position are you going to scan Zola in?

What sites do we currently assess?

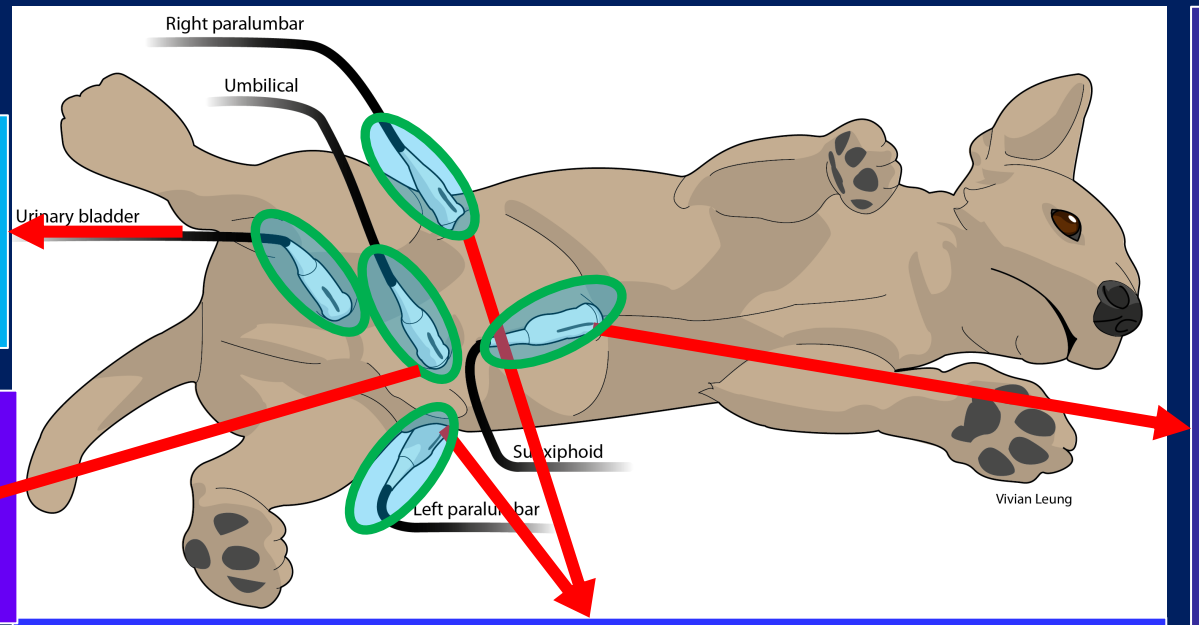


5-Point Abdominal POCUS Binary Questions

All Sites: 1) Is there free abdominal fluid Y/N*

3) Urine* production Y/N
3b) Pyometra?

12) Splenic masses? More research needed



4) Is there generalized ileus Y/N?* (duodenum)
5) Is there renal pelvic dilation Y/N?

6) Is there gall bladder wall* edema Y/N
7) Is there gastric ileus +/- fluid distention Y/N*
8) Is it OK to give a fluid bolus? Y/N (CVC assessment)**
9) *Is there pericardial effusion Y/N***
10) Is there CPR cardiac activity Y/N?
11) *Is there pleural effusion Y/N***

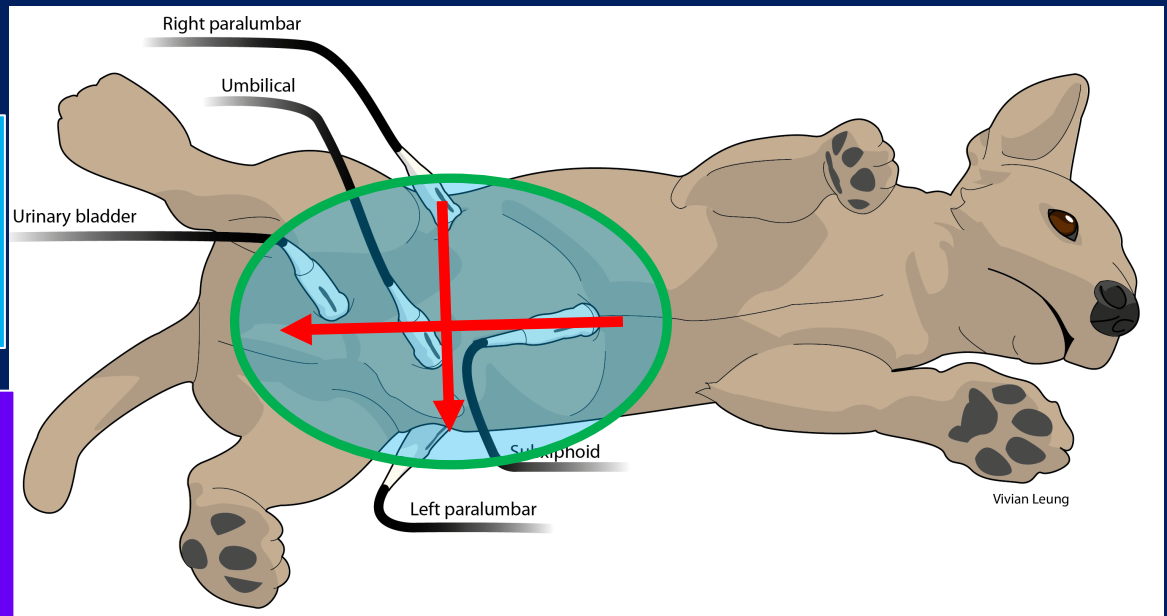
Combine the answer of abdominal POCUS findings with other POCUS results, history and clinical findings to narrow the differential diagnosis

What is the recommended order to scan?

All Sites: 1) Is there free abdominal fluid Y/N*

3) Urine* production Y/N
3b) Pyometra?

12) Splenic masses? More research needed



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Combine the answer of abdominal POCUS findings with other POCUS results, history and clinical findings to narrow the differential diagnosis

What position are you going to scan in?

- Can scan patients…
  - While on oxygen after anxiolytics
  - While giving fluids/performing life saving interventions

What position are you going to scan in?

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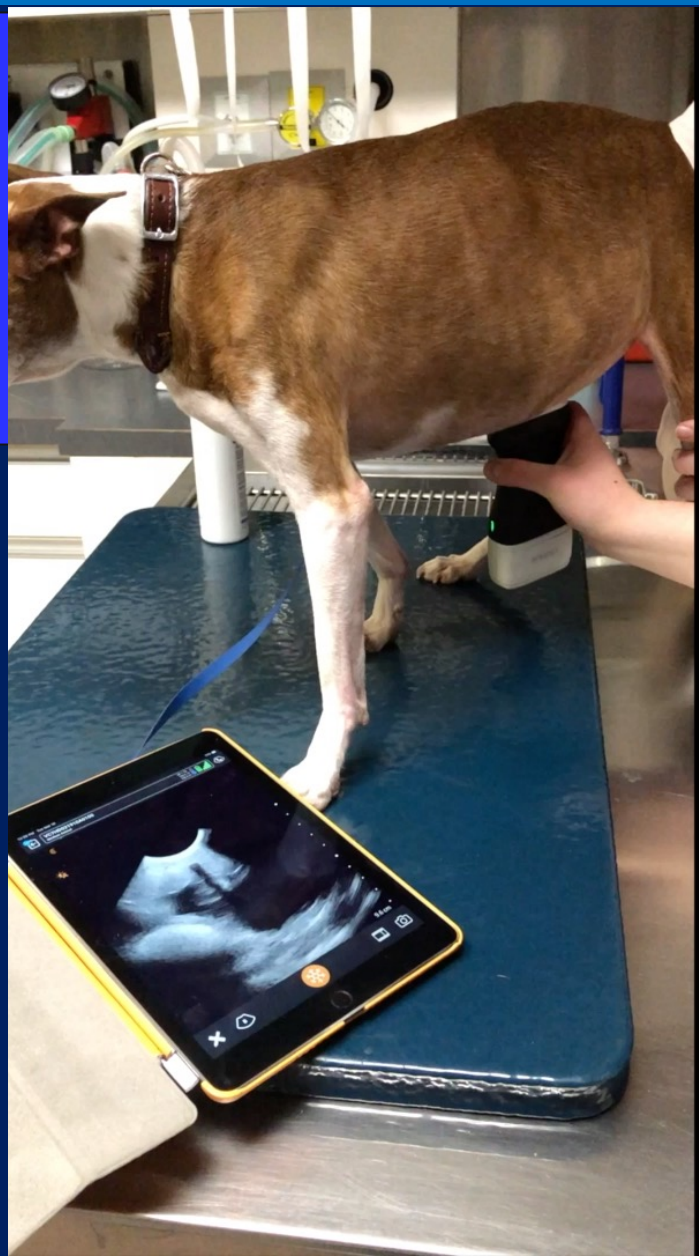

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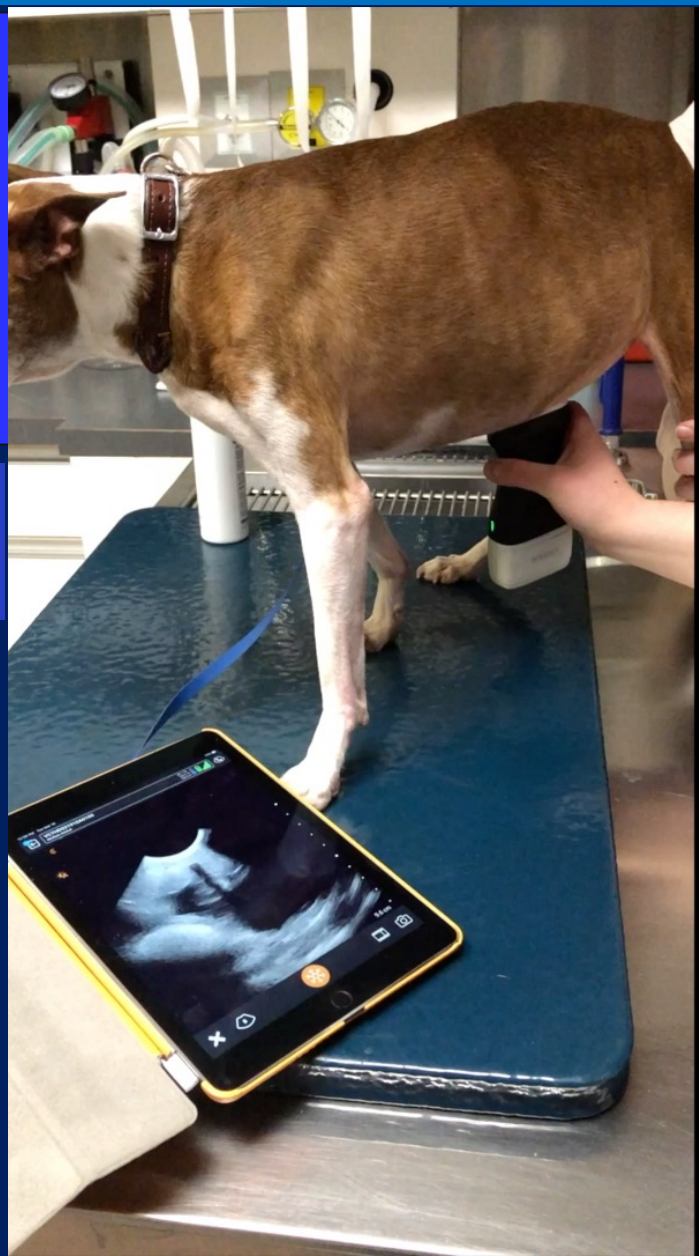
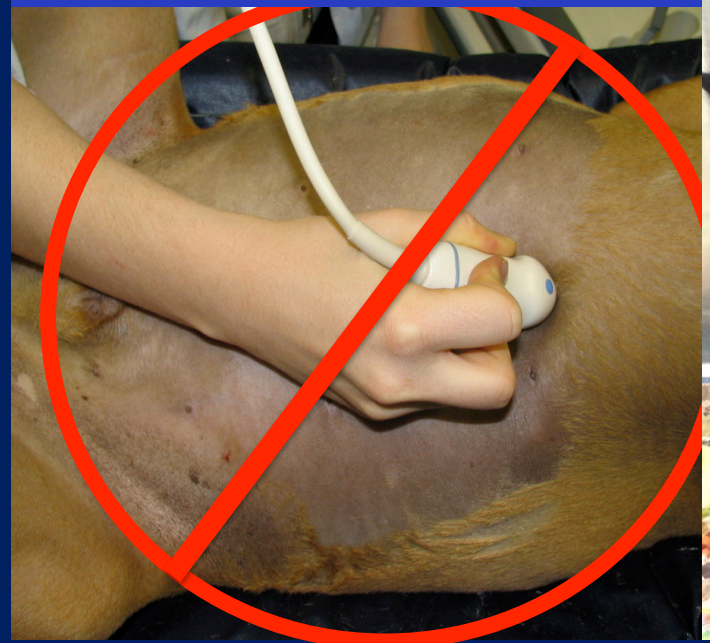


Avoid Dorsal!!



Zola and abdominal POCUS: What question(s) are most likely and are you comfortable trying to answer?

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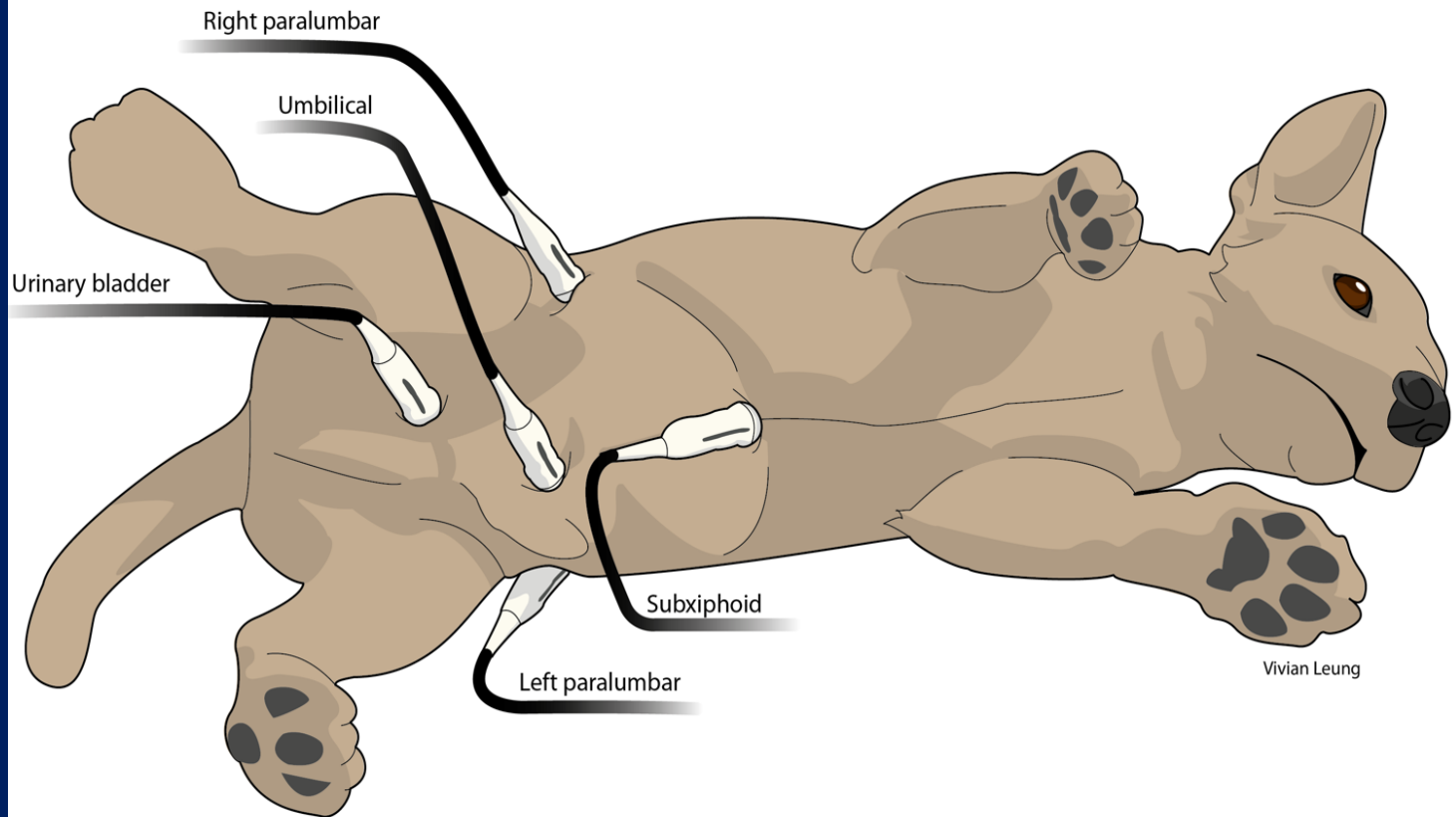


1) Free abdominal fluid Y/N?
2) Free abdominal air Y/N?
3) Gall bladder wall edema Y/N?
4) Urine production (+/- pyometra) Y/N?
5) Generalized ileus Y/N? (duodenum)
6) Renal pelvic dilation Y/N?
7) Gastric ileus +/- fluid distention Y/N?
8) Fluid bolus OK? Y/N (CVC assessment)
9) Pericardial effusion Y/N?
10) CPR cardiac activity Y/N?
11) Pleural effusion Y/N?
12) Caudal lung pathology Y/N?
13) Splenic mass if Hemoabdomen Y/N?

How Accurate is abdominal POCUS for fluid?

JOURNAL OF Veterinary Emergency AND Critical Care

Original Study

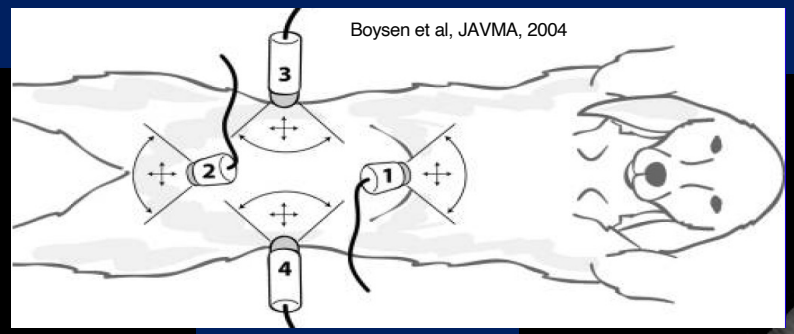
Journal of Veterinary Emergency and Critical Care () 2018, pp 1–7
doi: 10.1111/vec.12732

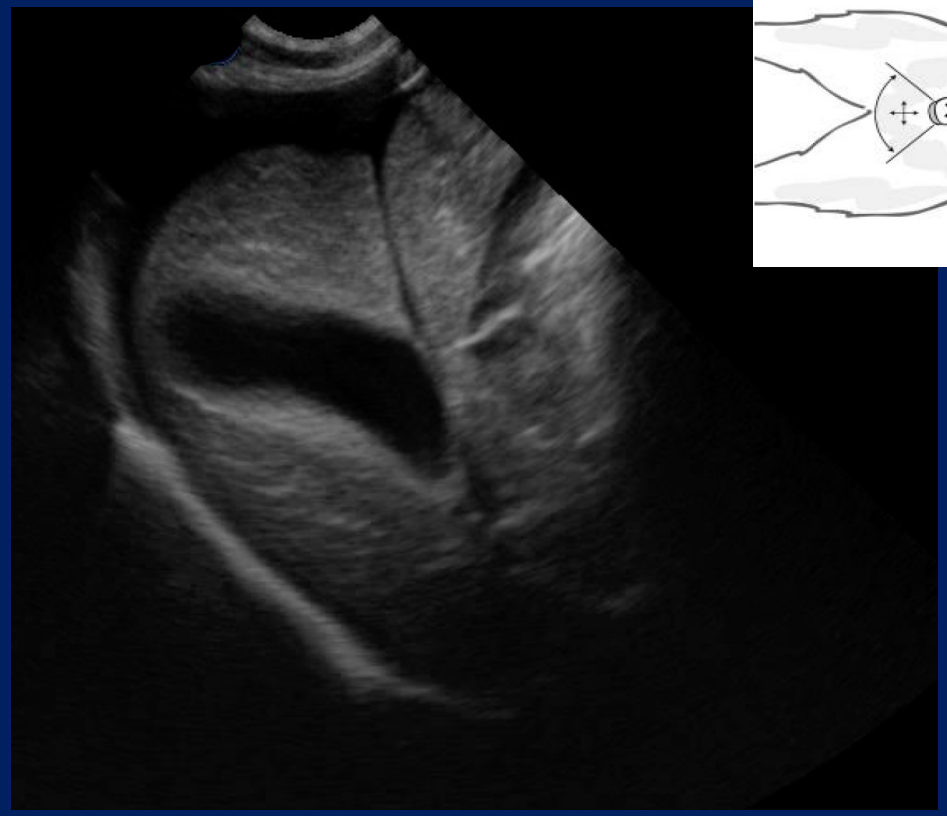
Evaluation of the agreement between focused assessment with sonography for trauma (AFAST/TFAST) and computed tomography in dogs and cats with recent trauma

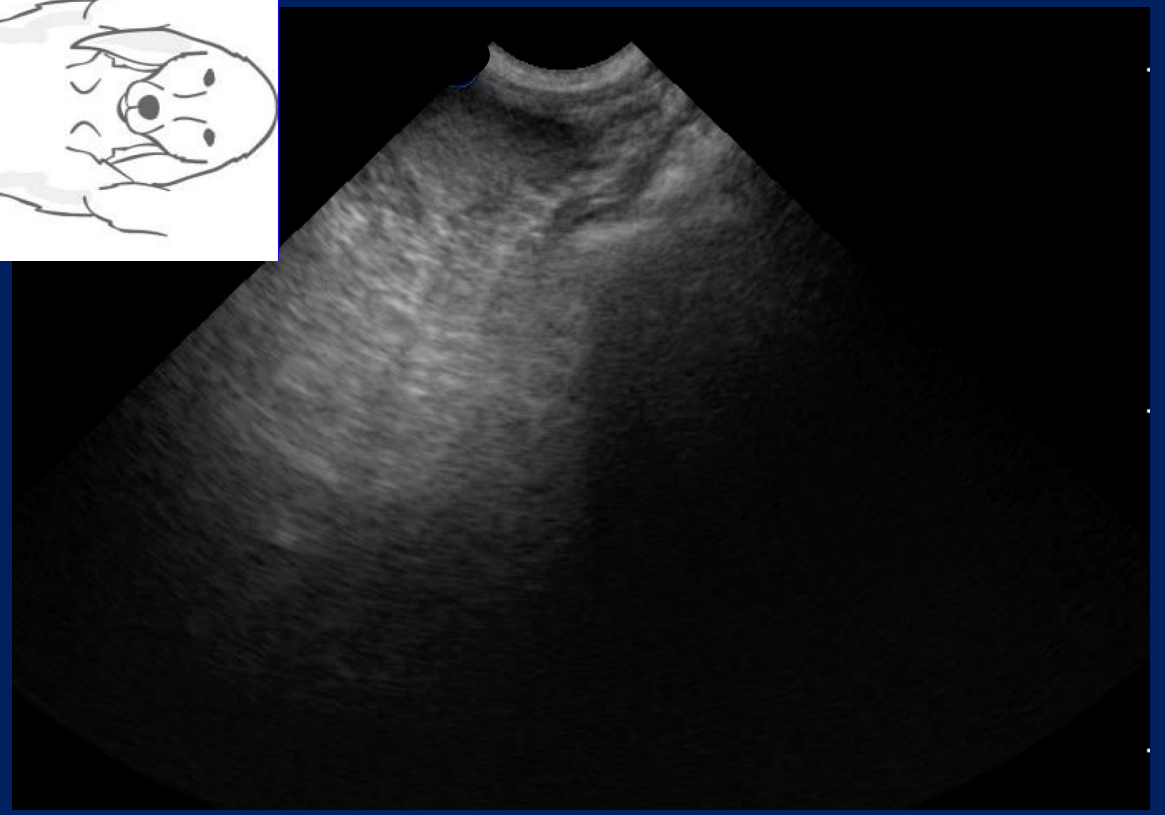
Walters, et al, 2018

Abdominal POCUS vs. CT (fluid) : Kappa 0.82 = excellent agreement using original 2004 abdominal FAST protocol!

Likely higher umbilical site and serial exams included







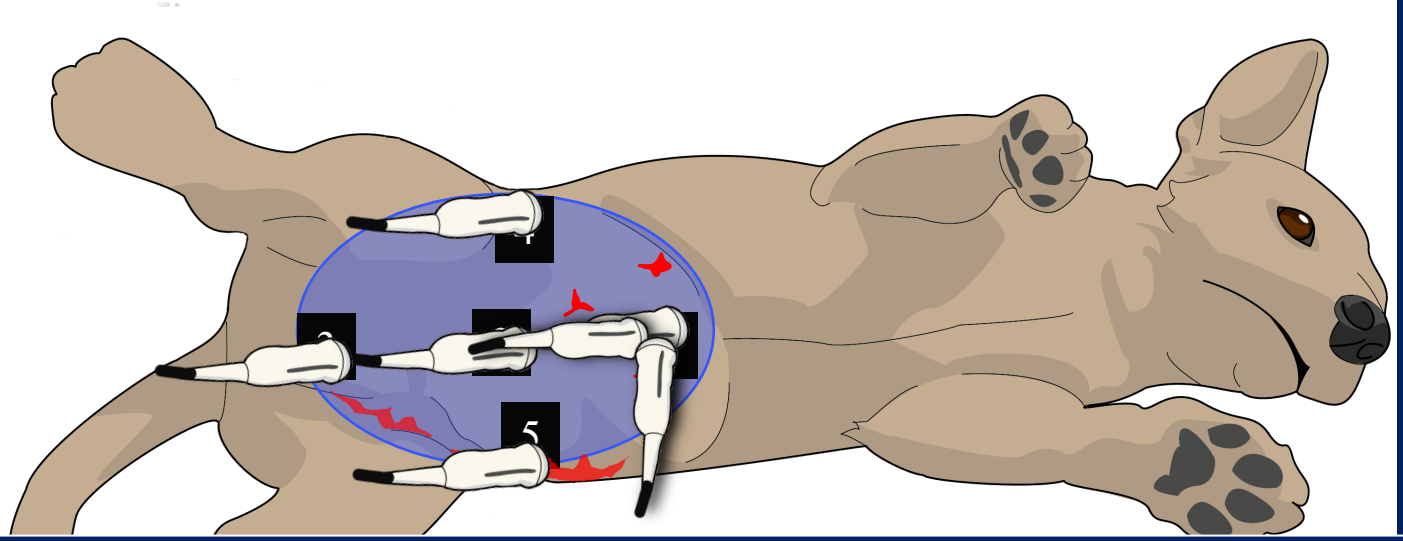
Question 1: Is there free abdominal fluid Y/N – important considerations

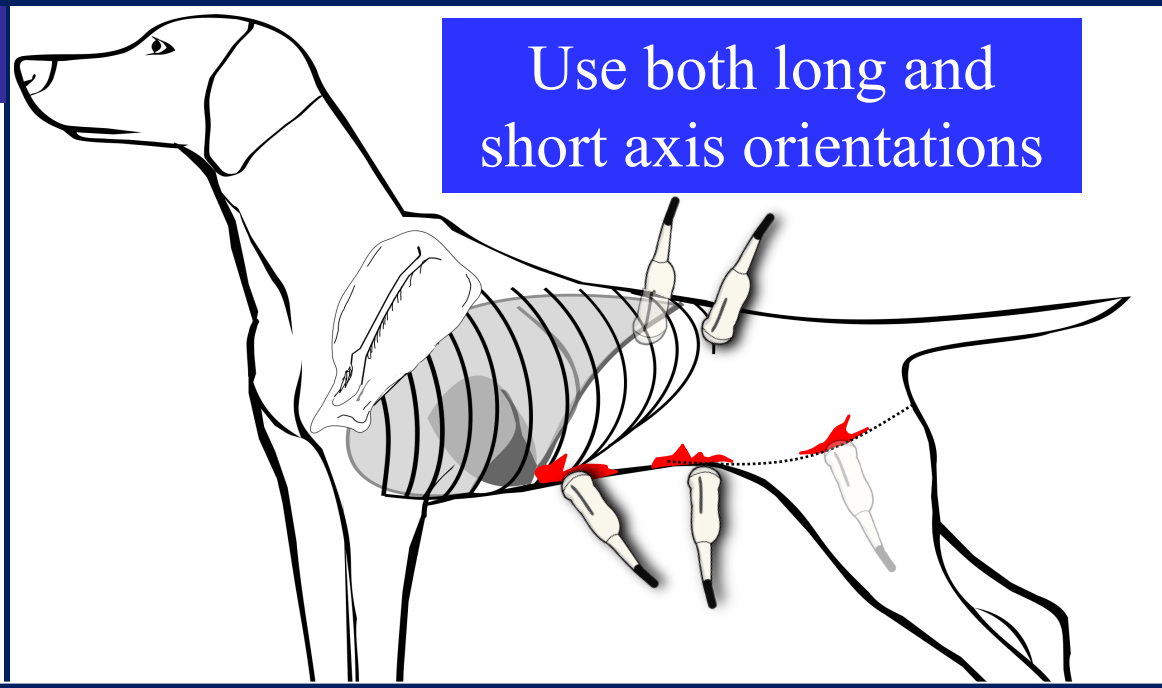
a) Fluid can accumulate anywhere:

b) Fluid accumulates at different locations with patient position:

c) Fluid can be trapped by adhesions/omentum:

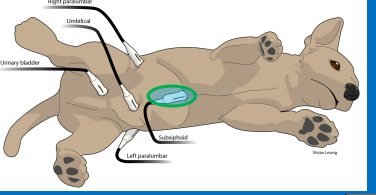
Why it is a 5-point abdominal POCUS exam!



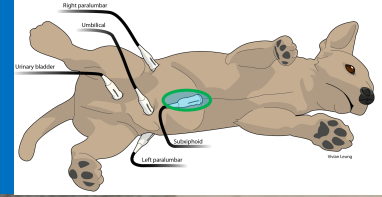


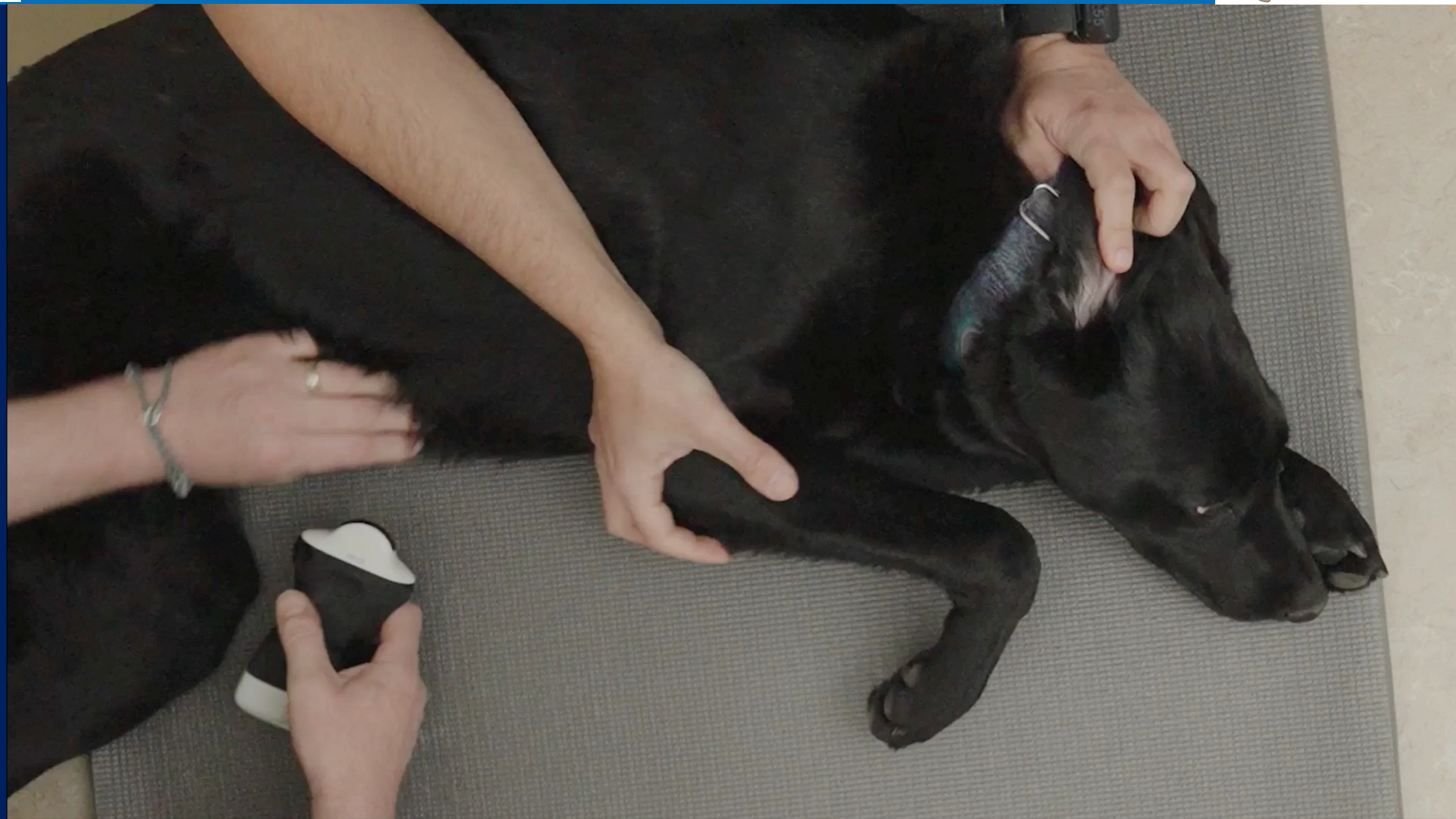
Use both long and short axis orientations

Each binary question must be answered thoroughly: Patient position, pathology to search, use multiple sites, change probe orientation



Subxiphoid site





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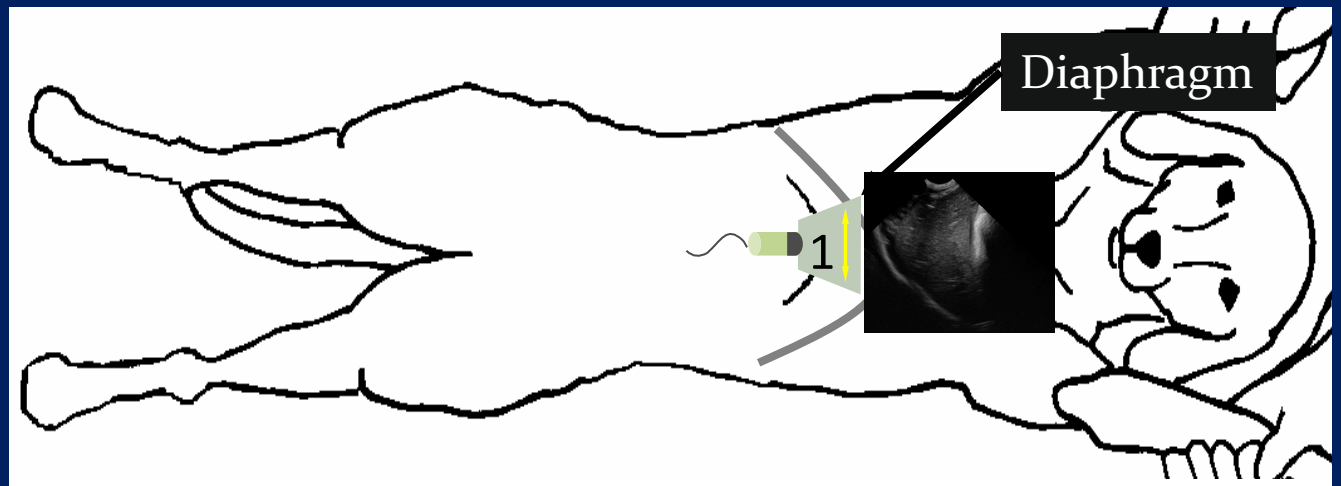
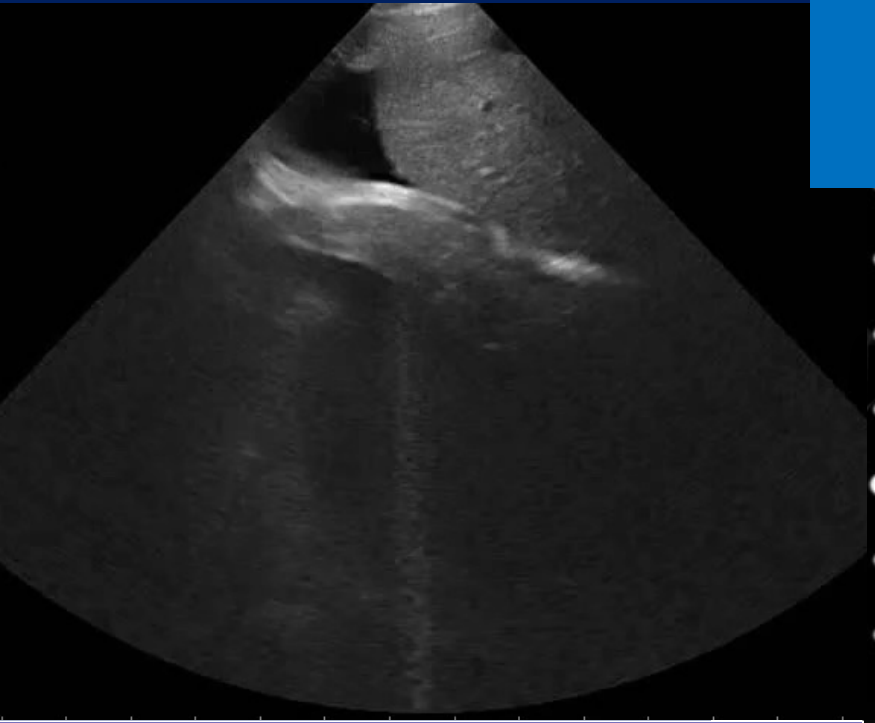
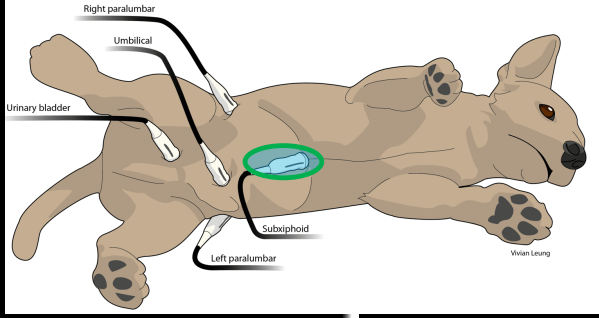


Modified from Boysen et al, J Am Vet Med Assoc. 2004 Oct 15;225(8):1198-204.

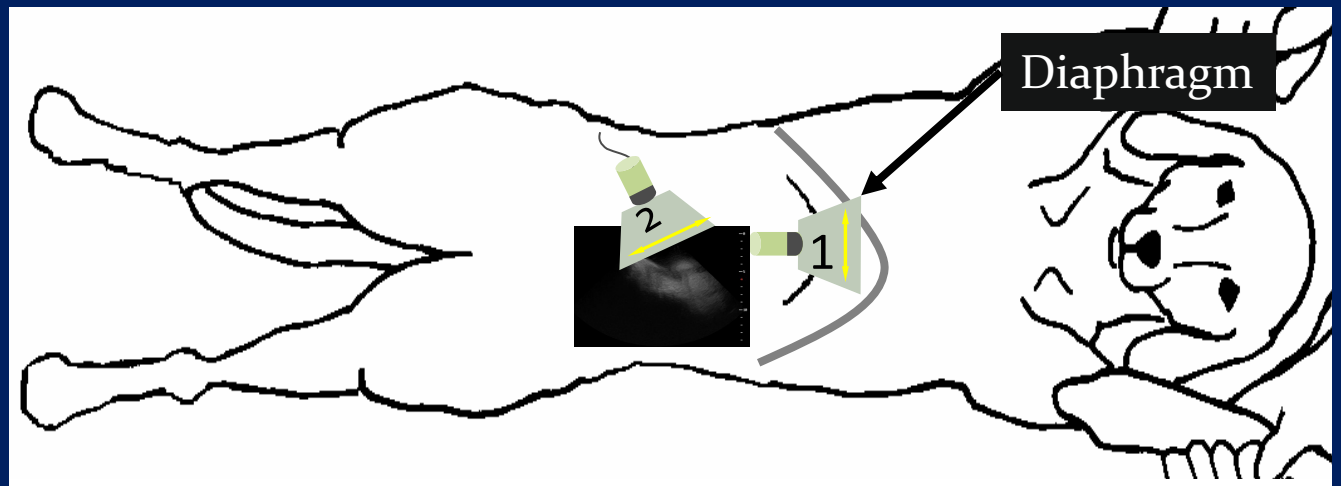
Zola





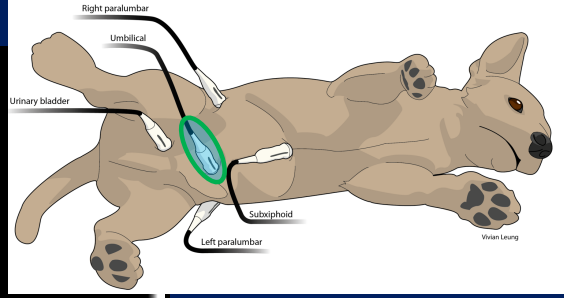
1. *Free abdominal fluid?*
2. ~~*Free abdominal air?*~~
3. ~~*Gall bladder wall edema?*~~
4. *OK to give a fluid bolus?*
5. ~~*Pericardial effusion*~~

Question 1: Is there free abdominal fluid Y/N

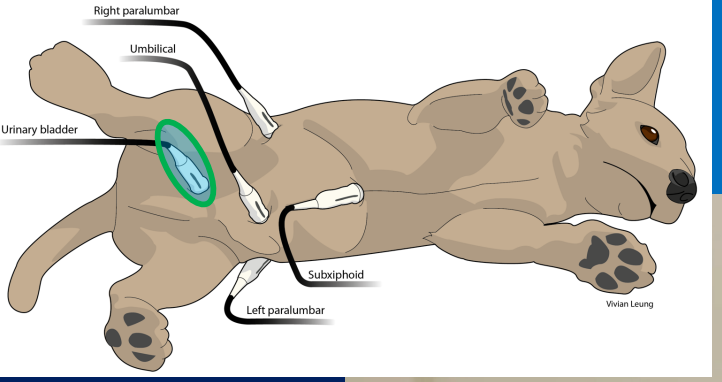


Modified from Boysen et al, J Am Vet Med Assoc. 2004 Oct 15;225(8):1198-204.

Zola


Right paralumbar
Umbilical
Urinary bladder
Subxiphoid
Left paralumbar
Vivian Leung

Urinary bladder site



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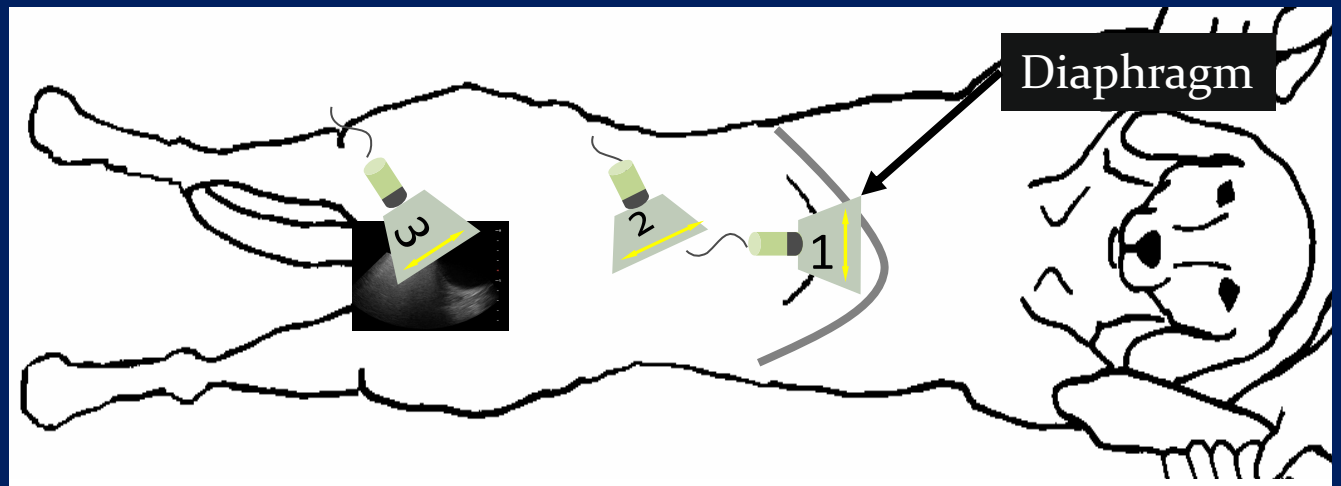

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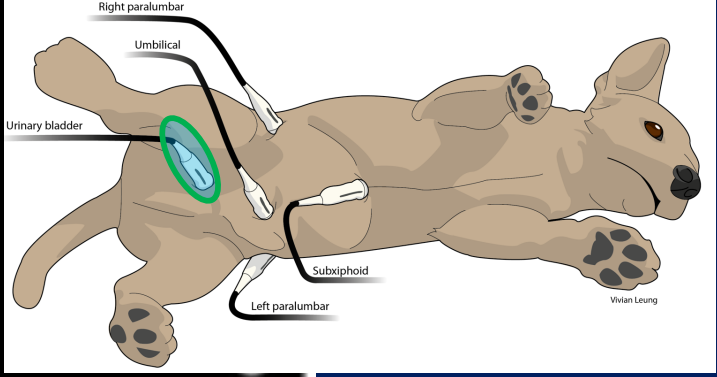
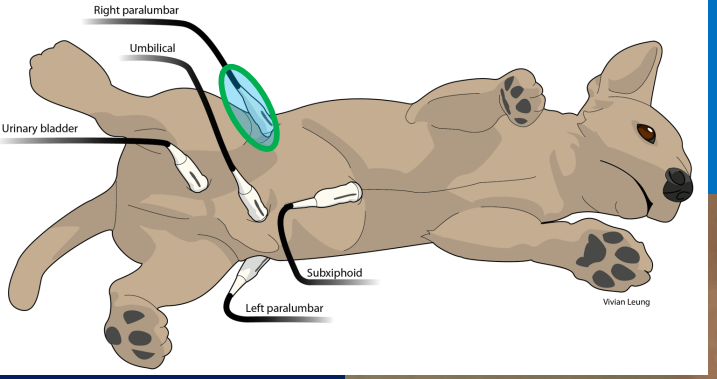

Right paralumbar
Umbilical
Urinary bladder
Subxiphoid
Left paralumbar
Vivian Leung

Right paralumbar site



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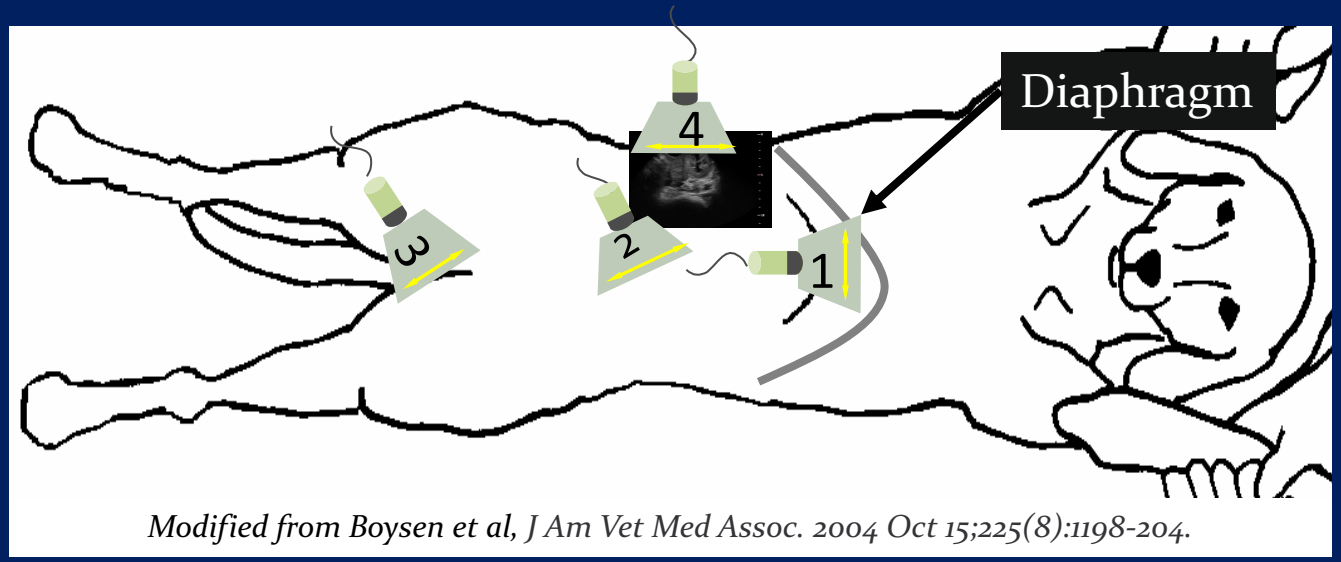

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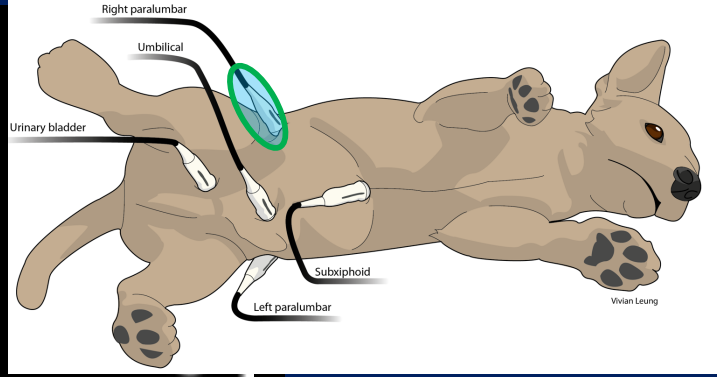
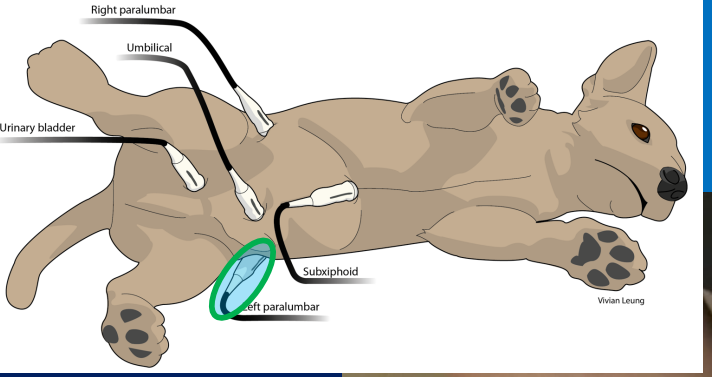

Right paralumbar
Umbilical
Urinary bladder
Subxiphoid
Left paralumbar
Vivian Leung

Left paralumbar site



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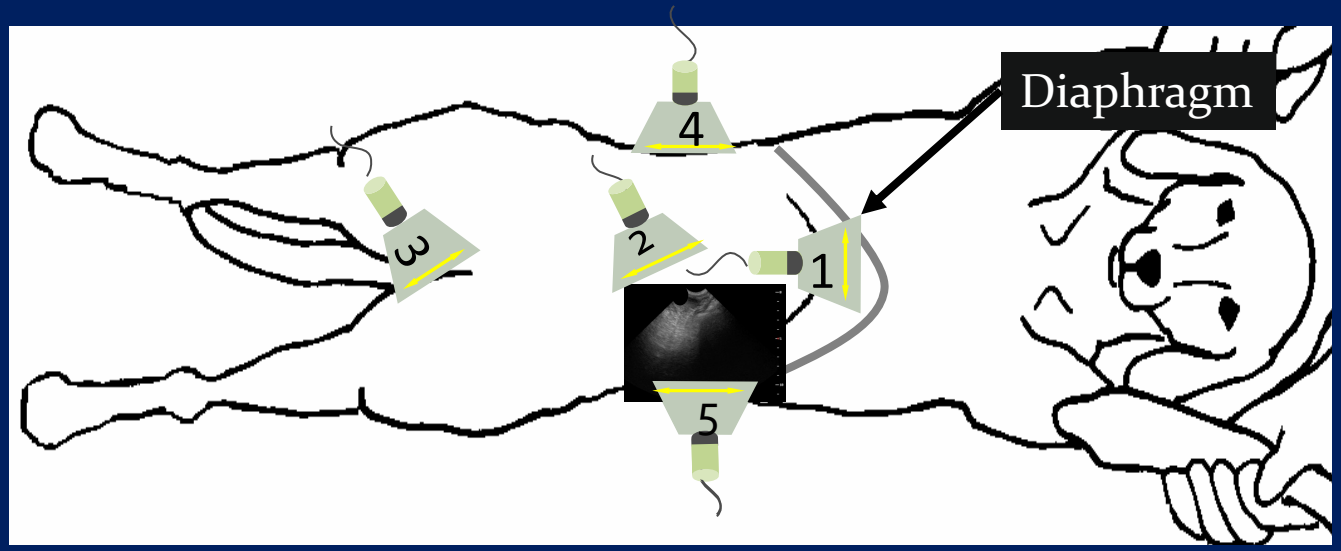
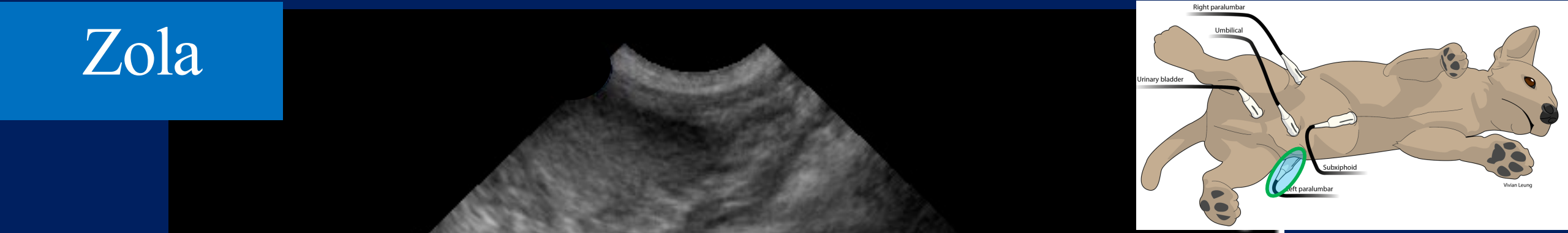
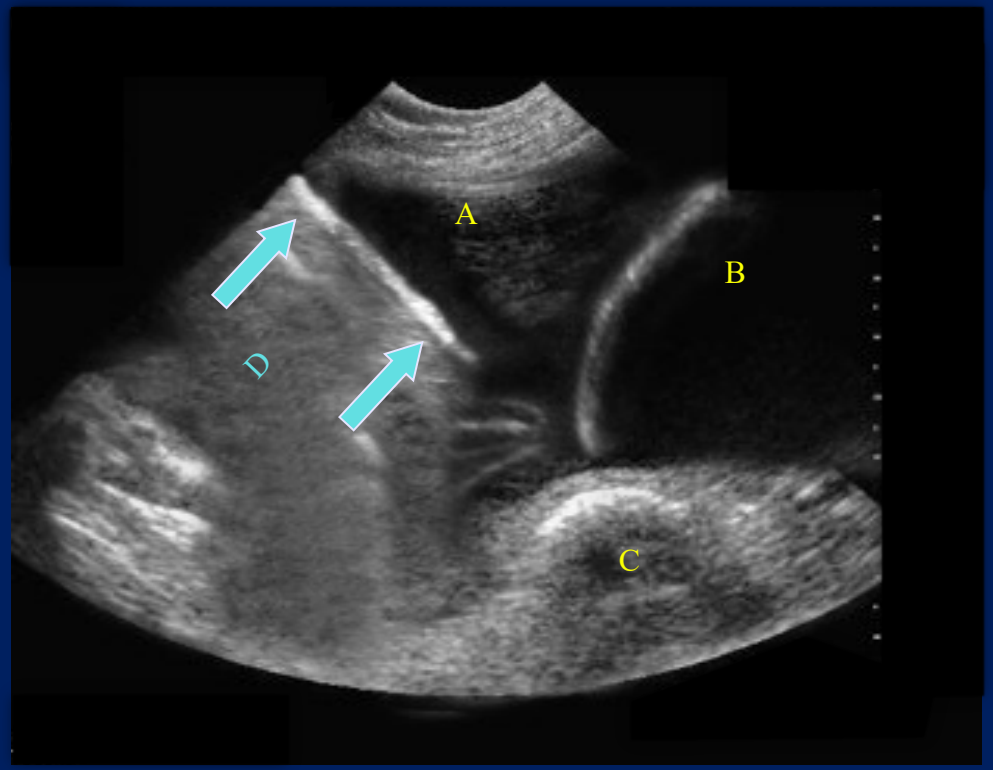


Zola


Right paralumbar
Umbilical
Urinary bladder
Subxiphoid
Left paralumbar
Vivian Leung

Localize injury to the abdomen, but not the specific organ injured
Centesis and fluid analysis is helpful in the first 5 minutes

What is the type of free fluid?

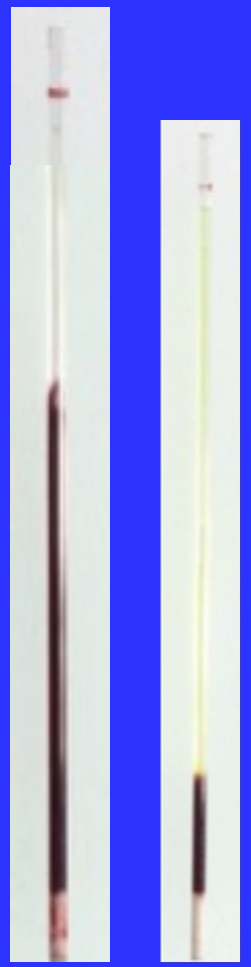


Perform Abdominocentesis

Zola

- If abdominal PCV is much lower than peripheral PCV following trauma think dilution and uroabdomen
- How do you confirm this?

Peripheral (49%)



Abdominal (12%)

Serosanguinous

Uroabdomen

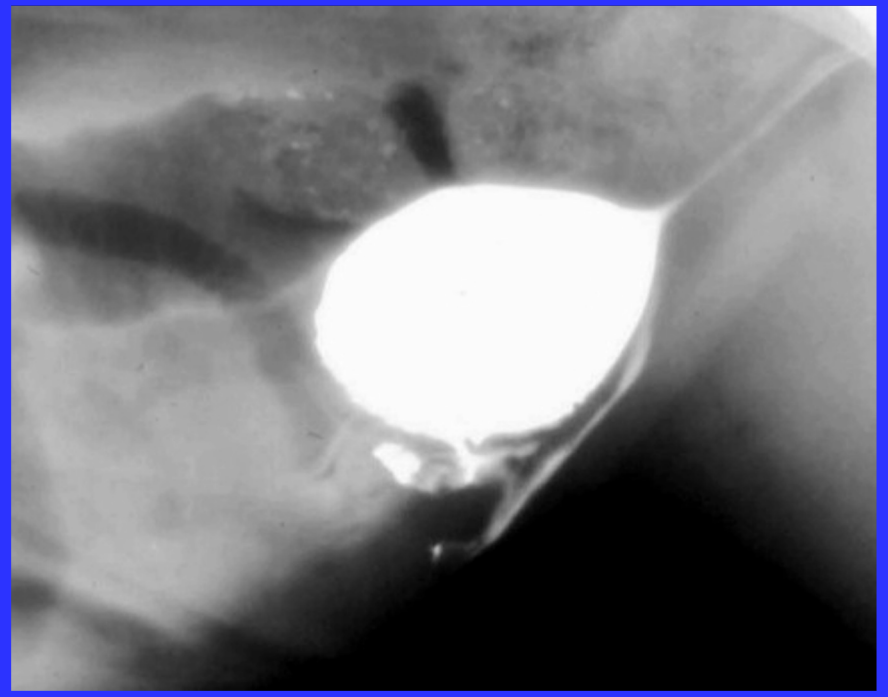
- Fluid compared to peripheral blood
  - Uroabdomen
    - Abdomen to peripheral K+ ratio >1.4:1 (dogs)
      (Schmiedt et al, JVECCS Dec 2001)
    - Abdomen to peripheral Creat ratio >2:1 (dogs)
      (Schmiedt et al, JVECCS Dec 2001)

Zola

- Stabilize

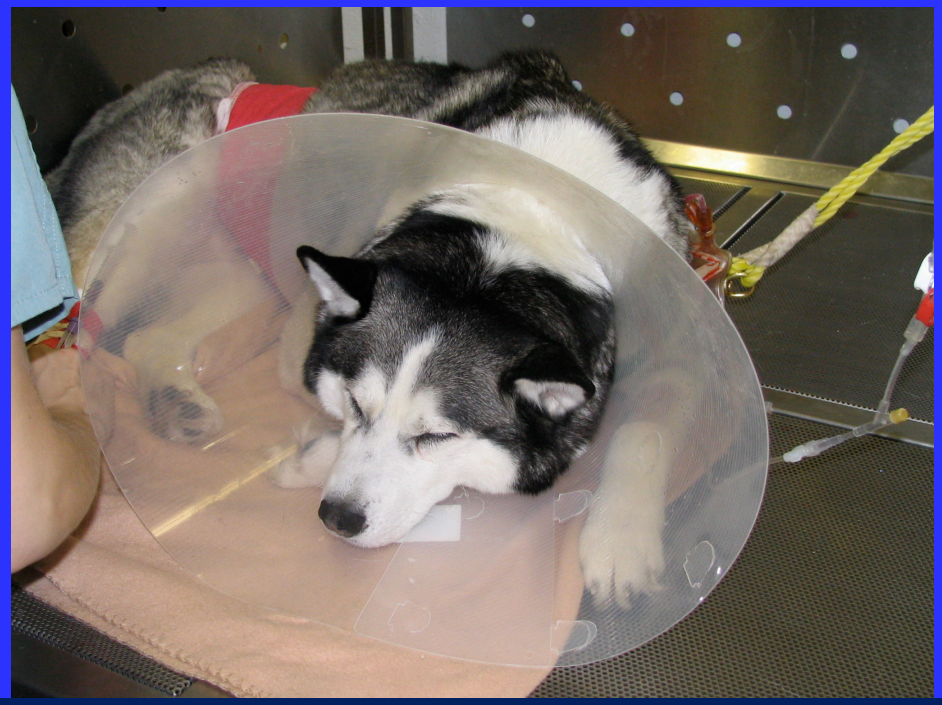
Zola…location of injury?

- Contrast study
  - Urethrocystogram –interpretation?



Prognosis

- Mortality rate of 78% if not treated
- Survival rate in dogs and cats with urinary bladder or urethral rupture is with treatment 73-79% (slightly better in dogs)

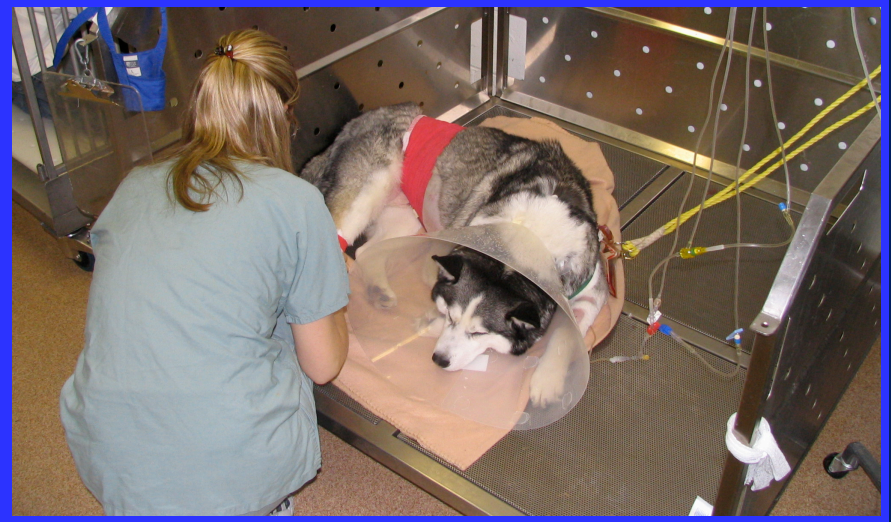


Zola's outcome

- Hemoabdomen
  - Transfusion at 4 hour mark
- Uroabdomen
  - Surgery at 16 hours to repair bladder

Zola's post operative progression…

- Alert responsive
- Heart rate 102 bpm, respiratory rate 22
- Temperature 38.8C (101.6 F)
- Incision site unremarkable



- Removed urinary catheter day 3 post op – over night crew concerned about urine production

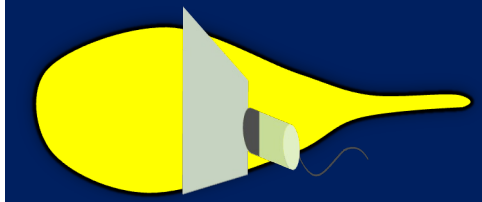
Estimating bladder volume

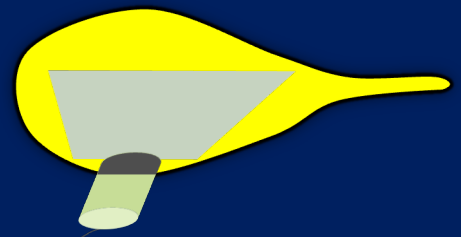
To noninvasively estimate urinary bladder volume:
Calculate the volume of a sphere

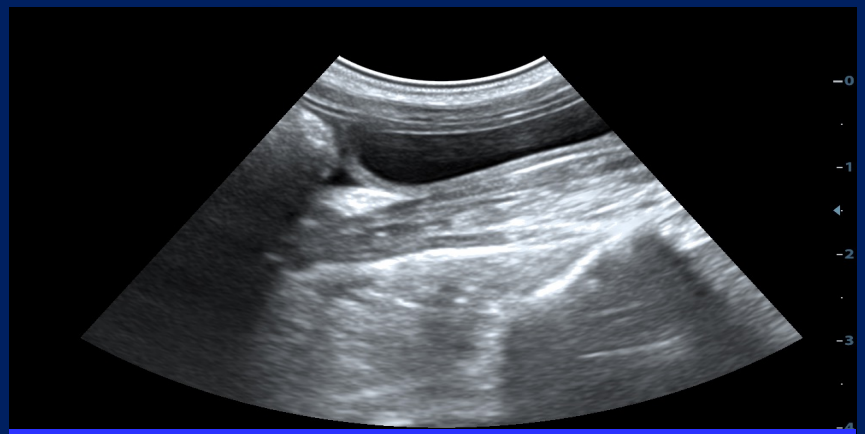
W x L x (DL+DT)/2 x0.52 (vs .625)

Gives you an estimation in milliliters

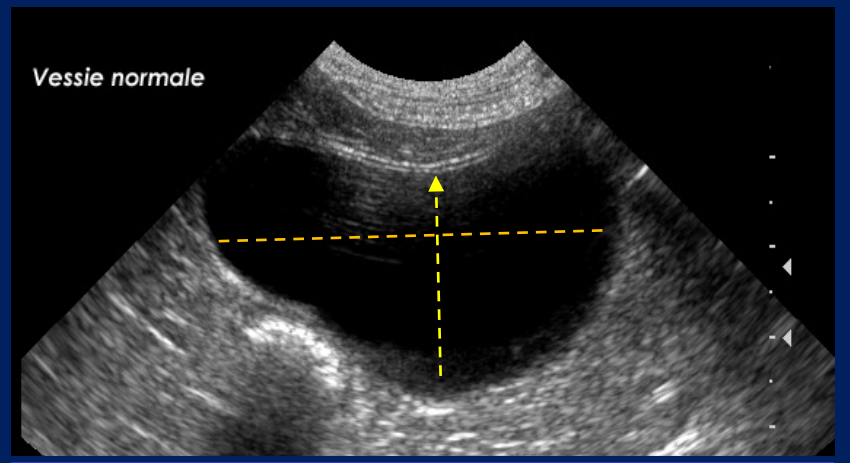

Journal of Veterinary Internal Medicine
Open Access
ACVIM
STANDARD ARTICLE | Open Access
Three-dimensional bladder ultrasound to measure daily urinary bladder volume in hospitalized dogs
Edward J. Vasquez, Allison Kendall, Sarah Musulin, Shelly L. Vaden
First published: 31 July 2021 | https://doi.org/10.1111/jvim.16232



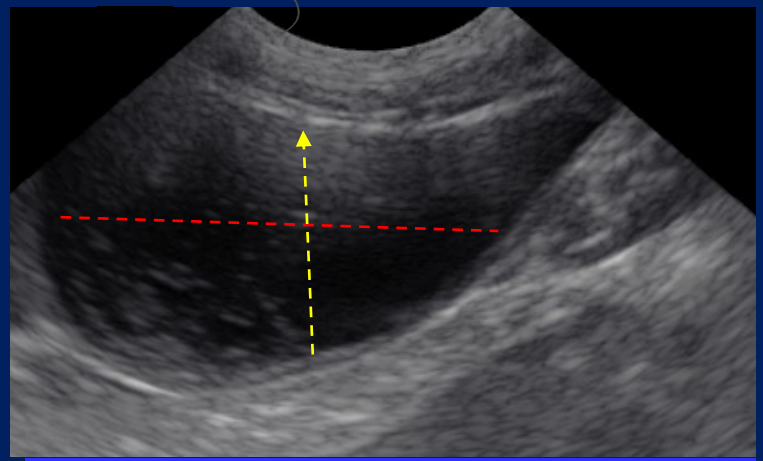




Avoid compressing bladder
It's the volume of a sphere!



Transverse (short axis)



Longitudinal (long axis)

Summary

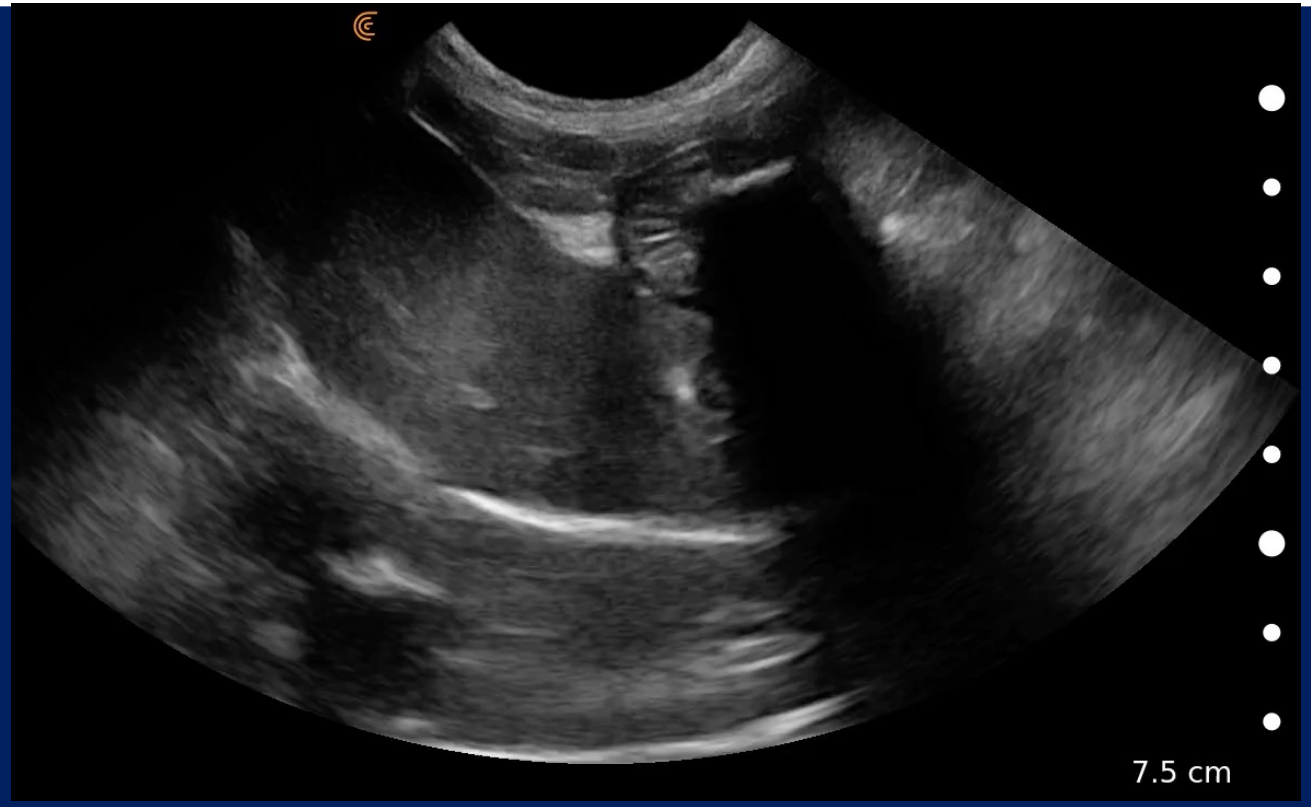
- Consider the history and initial findings to determine the POCUS question to ask first

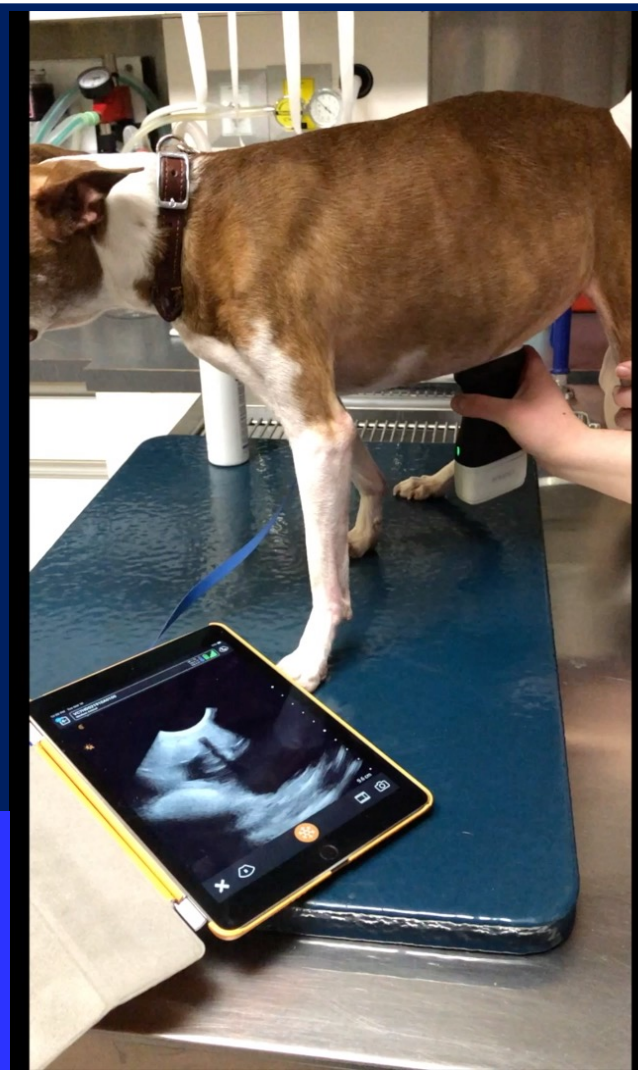
Zola did go home!

Summary

- Consider the history and initial findings to determine the POCUS question to ask first
- Don’t forget that patient positioning will influence where sonographically detectable pathology accumulates
- Ultrasound is one of the earliest modalities to detect fluid including uroabdomen
- Fluid analysis is needed to (K+/creatinine fluid:plasma ratios) confirm uroabdomen
- Contrast studies help localize the specific urinary tract site of injury

Questions?





Søren Boysen, DVM, DACVECC
Serge Chalhoub DVM, DACVIM
Department of Veterinary and Clinical Diagnostic Sciences
srboysen@ucalgary.ca, schalhou@ucalgary.ca

Live Demonstration

Dr. Oron Frenkel, MD, MS

Emergency Physician & POCUS Educator

Chairman, Clarius Medical Advisory Board

clarius Ultrasound Anywhere

Poll

What additional information would you like?

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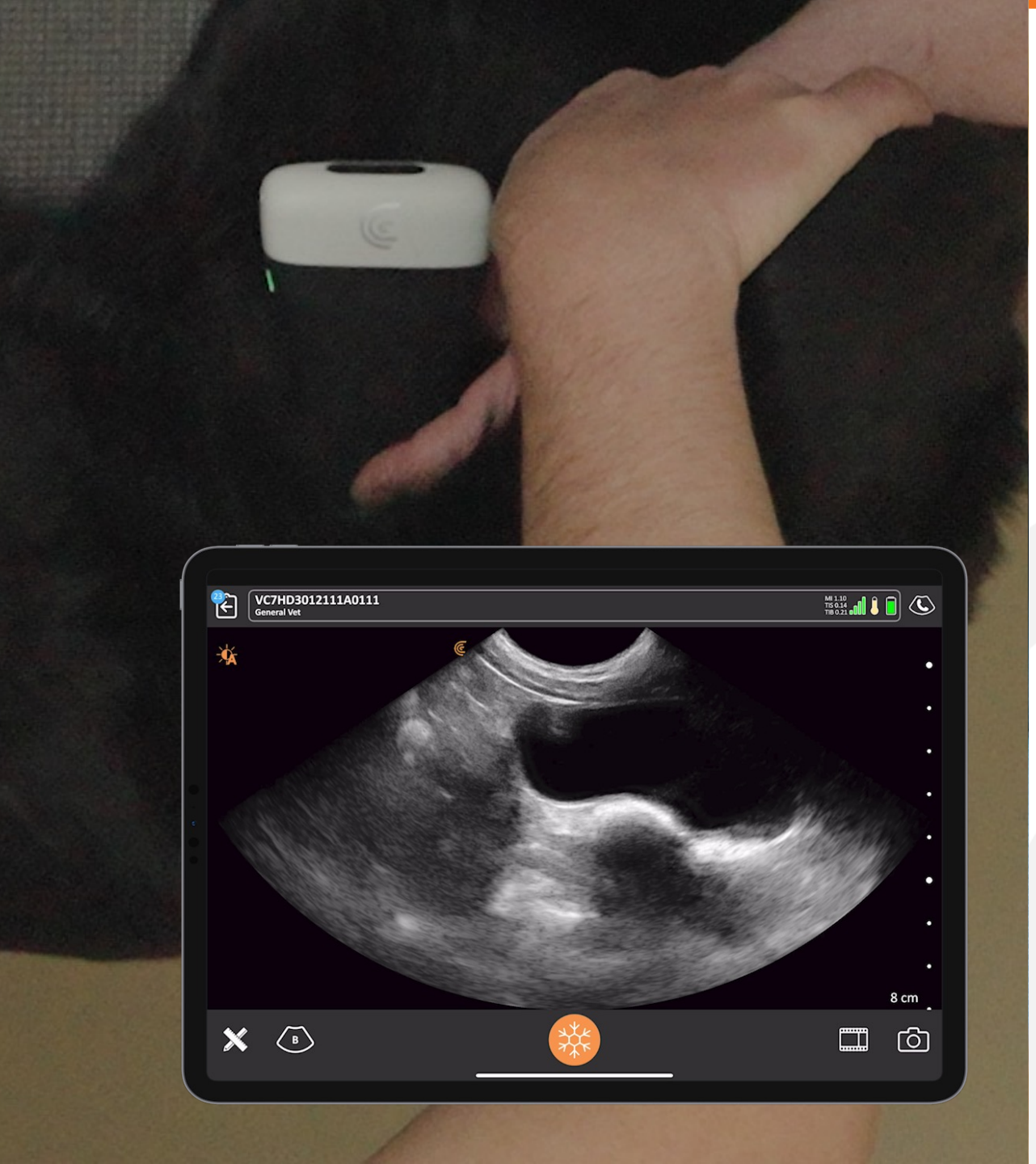
www.clarius.com/demo

www.clarius.com/classroom



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Questions?

Dr. Soren Boysen, DVM, DACVECC

srboysen@ucalgary.ca

Dr. Serge Chalhoub, DVM, DACVIM

schalhou@ucalgary.ca

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Thank you!