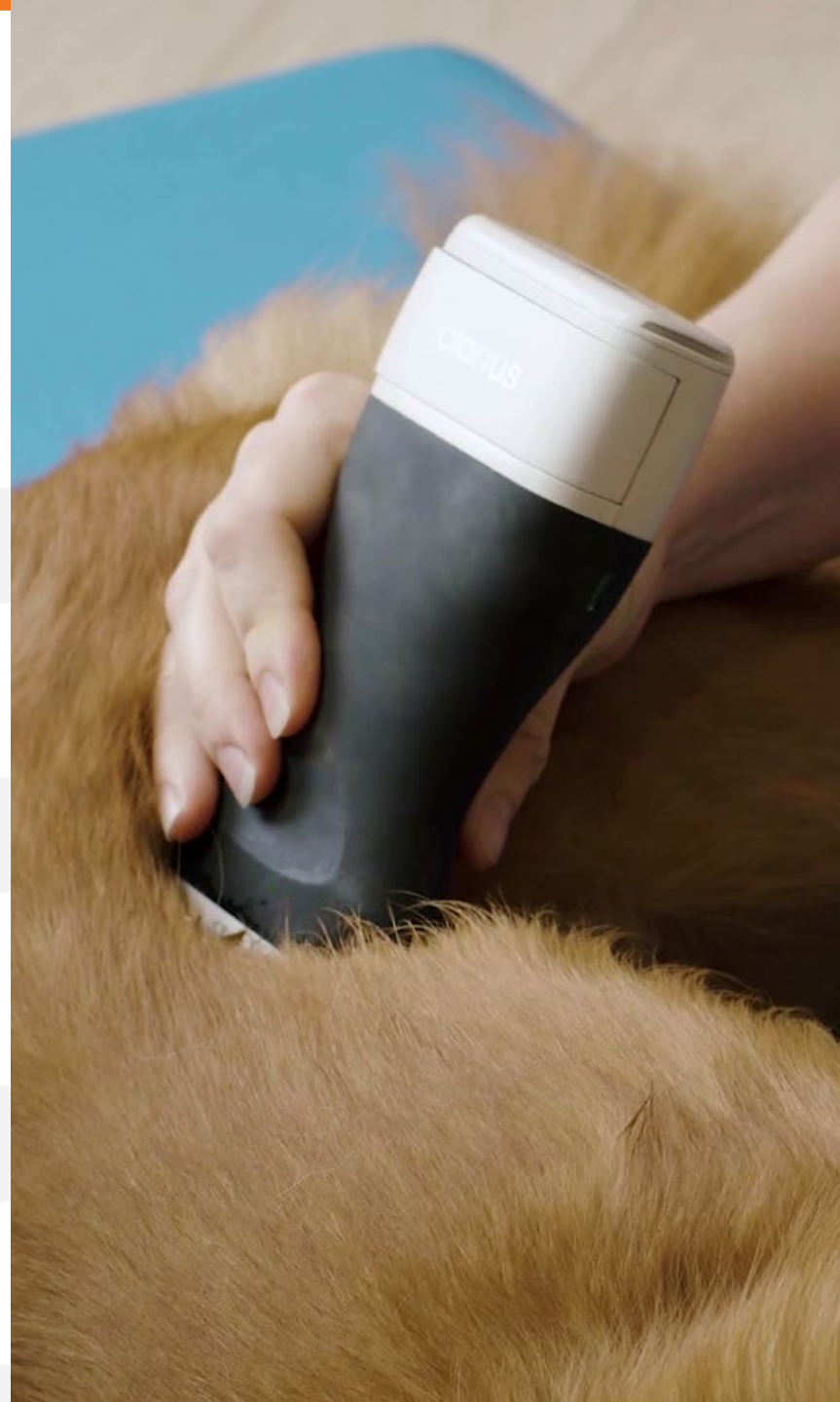
WEBINAR

Practical Small Animal Ultrasound: Scanning the Pancreas and Adrenals for Common Pathologies

November 2021

clarius



Your Host

Dr. Oron Frenkel, MD, MS

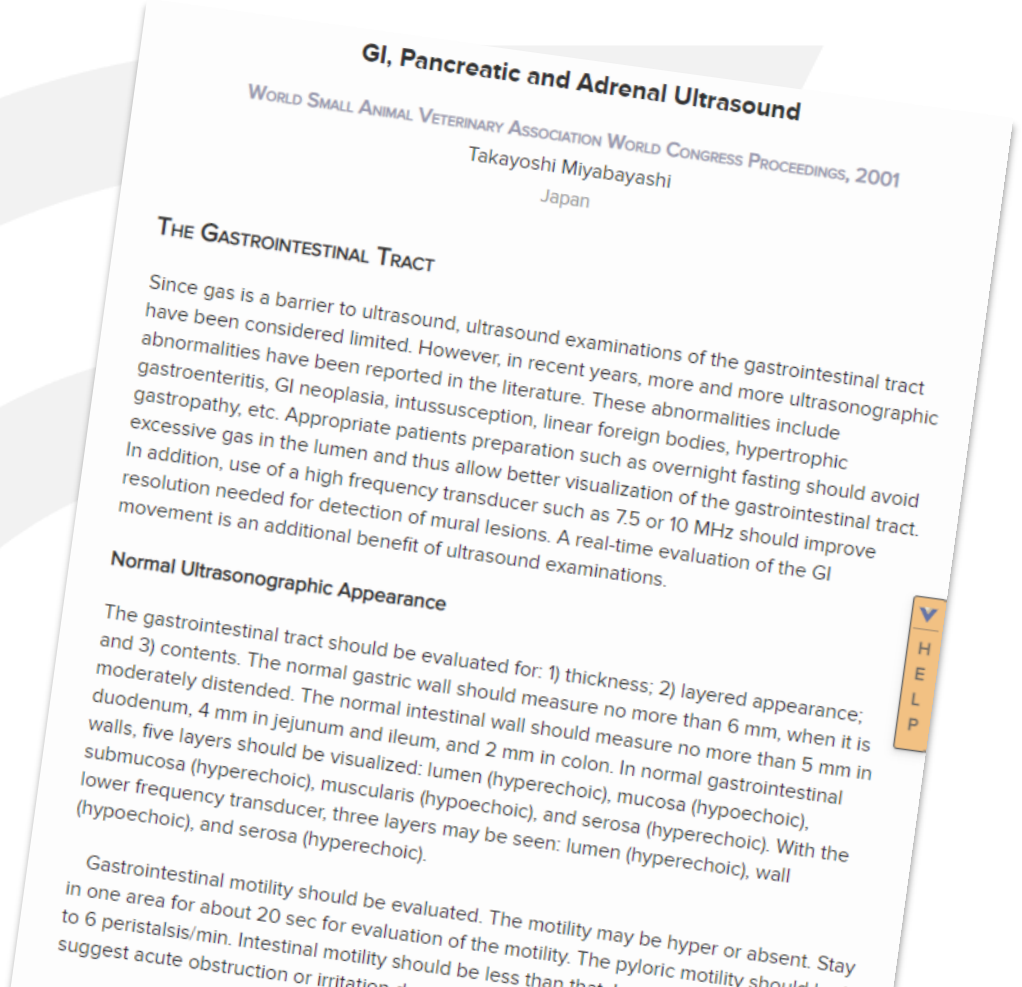
Emergency Physician & POCUS Educator

Chairman, Clarius Medical Advisory Board

clarius Ultrasound Anywhere

GI, Pancreatic and Adrenal Ultrasound

"This is another new area where ultrasound examinations delineate morphological abnormalities. With an improved resolution of recent ultrasound machines, the pancreas is readily visible in normal dogs."



GI, Pancreatic and Adrenal Ultrasound

World Small Animal Veterinary Association World Congress Proceedings, 2001

Takayoshi Miyabayashi

Japan

THE GASTROINTESTINAL TRACT

Since gas is a barrier to ultrasound, ultrasound examinations of the gastrointestinal tract have been considered limited. However, in recent years, more and more ultrasonographic abnormalities have been reported in the literature. These abnormalities include gastroenteritis, GI neoplasia, intussusception, linear foreign bodies, hypertrophic gastropathy, etc. Appropriate patients preparation such as overnight fasting should avoid excessive gas in the lumen and thus allow better visualization of the gastrointestinal tract. In addition, use of a high frequency transducer such as 7.5 or 10 MHz should improve resolution needed for detection of mural lesions. A real-time evaluation of the GI movement is an additional benefit of ultrasound examinations.

Normal Ultrasonographic Appearance

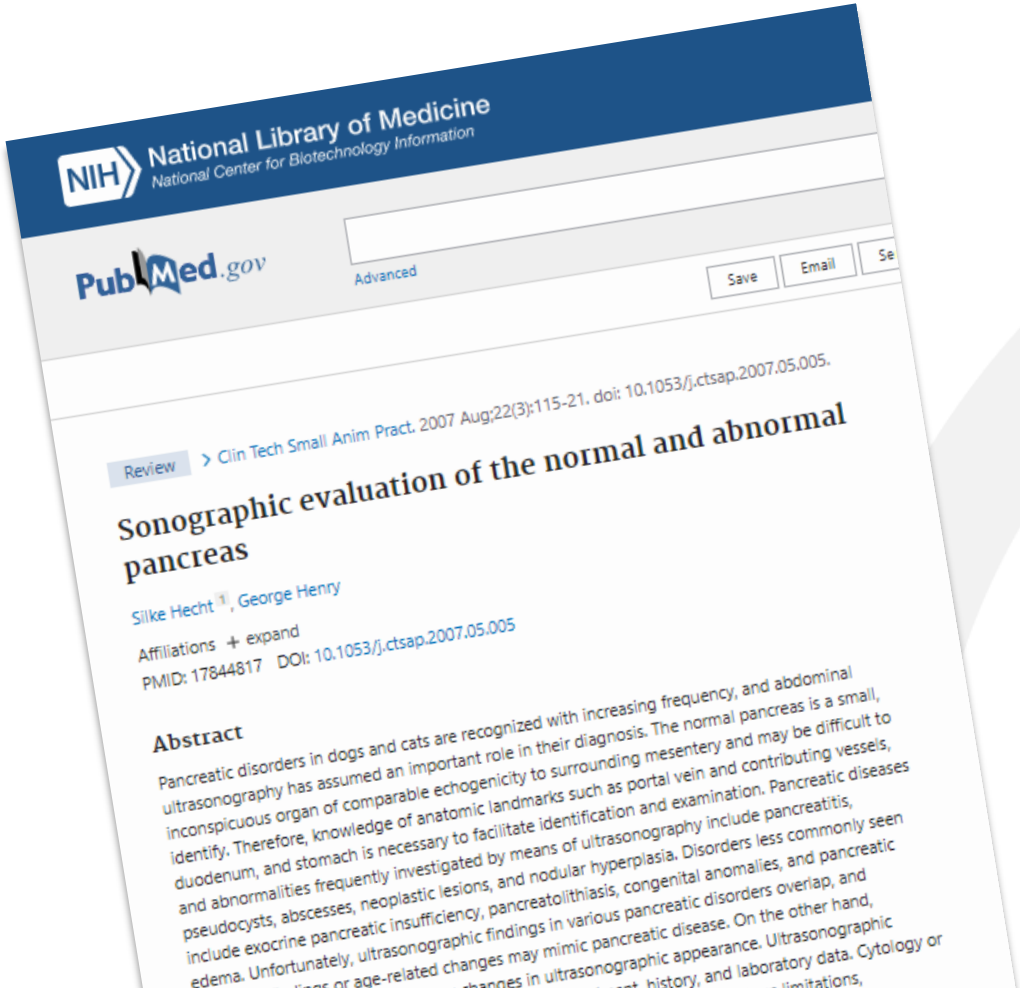
The gastrointestinal tract should be evaluated for: 1) thickness; 2) layered appearance; and 3) contents. The normal gastric wall should measure no more than 6 mm, when it is moderately distended. The normal intestinal wall should measure no more than 5 mm in duodenum, 4 mm in jejunum and ileum, and 2 mm in colon. In normal gastrointestinal walls, five layers should be visualized: lumen (hyperechoic), mucosa (hypoechoic), submucosa (hyperechoic), muscularis (hypoechoic), and serosa (hyperechoic). With the lower frequency transducer, three layers may be seen: lumen (hyperechoic), wall (hypoechoic), and serosa (hyperechoic).

Gastrointestinal motility should be evaluated. The motility may be hyper or absent. Stay in one area for about 20 sec for evaluation of the motility. The pyloric motility should

HELP

Takayoshi Miyabayashi. GI, Pancreatic and Adrenal Ultrasound. World Small Animal Veterinary Association World Congress Proceedings, 2001. Source: https://www.vin.com/apputil/content/defaultadv1.aspx?pId=8708&id=3843781

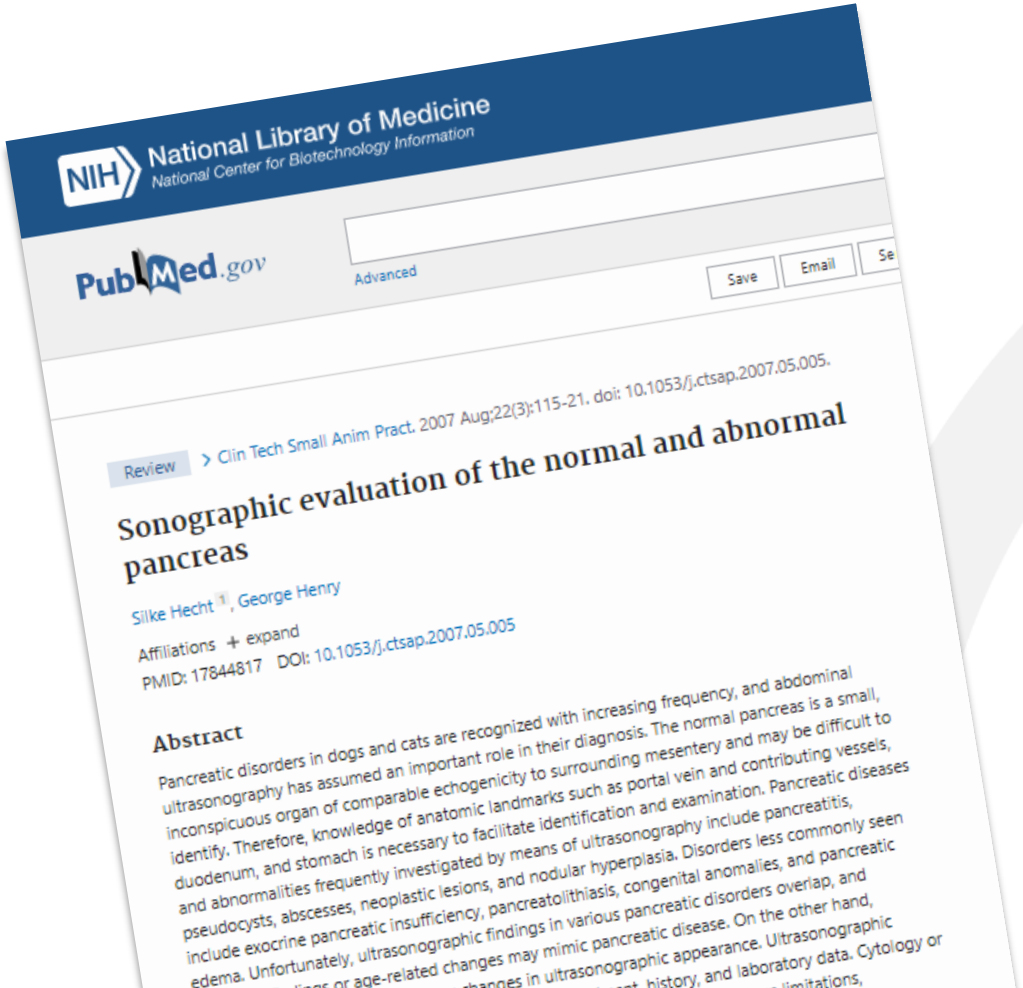
Sonographic Evaluation of the Normal and Abnormal Pancreas



"Pancreatic diseases and abnormalities frequently investigated by means of ultrasonography include pancreatitis, pseudocysts, abscesses, neoplastic lesions, and nodular hyperplasia."

Hecht S, Henry G. Sonographic evaluation of the normal and abnormal pancreas. Clin Tech Small Anim Pract. 2007 Aug;22(3):115-21. doi: 10.1053/j.ctsap.2007.05.005. PMID: 17844817.
Source: https://pubmed.ncbi.nlm.nih.gov/17844817/

Sonographic Evaluation of the Normal and Abnormal Pancreas



"...ultrasonography is useful in diagnosing pancreatic disease, guiding aspirates and biopsies, and monitoring response to treatment.

Hecht S, Henry G. Sonographic evaluation of the normal and abnormal pancreas. Clin Tech Small Anim Pract. 2007 Aug;22(3):115-21. doi: 10.1053/j.ctsap.2007.05.005. PMID: 17844817.
Source: https://pubmed.ncbi.nlm.nih.gov/17844817/

Ultrasonography of the Adrenal Glands in the Dog, Cat, and Ferret

"Ultrasonography has become an important modality for imaging adrenal glands in small animals. Normal adrenal glands and structural abnormalities, such as changes in size, shape, and echogenicity, can be identified."

Barthez PY, Nyland TG, Feldman EC. Ultrasonography of the adrenal glands in the dog, cat, and ferret. Vet Clin North Am Small Anim Pract. 1998 Jul;28(4):869-85. doi: 10.1016/s0195-5616(98)50082-4. PMID: 9698619. Source: https://pubmed.ncbi.nlm.nih.gov/9698619/

Feline Abdominal Ultrasonography: What's Normal? What's Abnormal?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Review > J Feline Med Surg. 2021 Jan;23(1):33-49. doi: 10.1177/1098612X20979509.

Feline abdominal ultrasonography: what's normal? what's abnormal? The adrenal glands

Sally Griffin [1]

Affiliations + expand

PMID: 33403910 DOI: 10.1177/1098612X20979509

Abstract

Practical relevance: Abdominal ultrasound plays a vital role in the diagnostic work-up of many cats presenting to general and specialist practitioners. Ultrasound examination of the adrenal glands can provide important information pertaining to several conditions including hyperaldosteronism and hyperadrenocorticism.

Clinical challenges: Despite ultrasonography being a commonly used modality, many practitioners are not comfortable performing an ultrasound examination or interpreting the resulting images. Even for the experienced ultrasonographer, differentiating between incidental findings, such as adrenal mineralisation, and clinically significant pathological changes can be challenging.

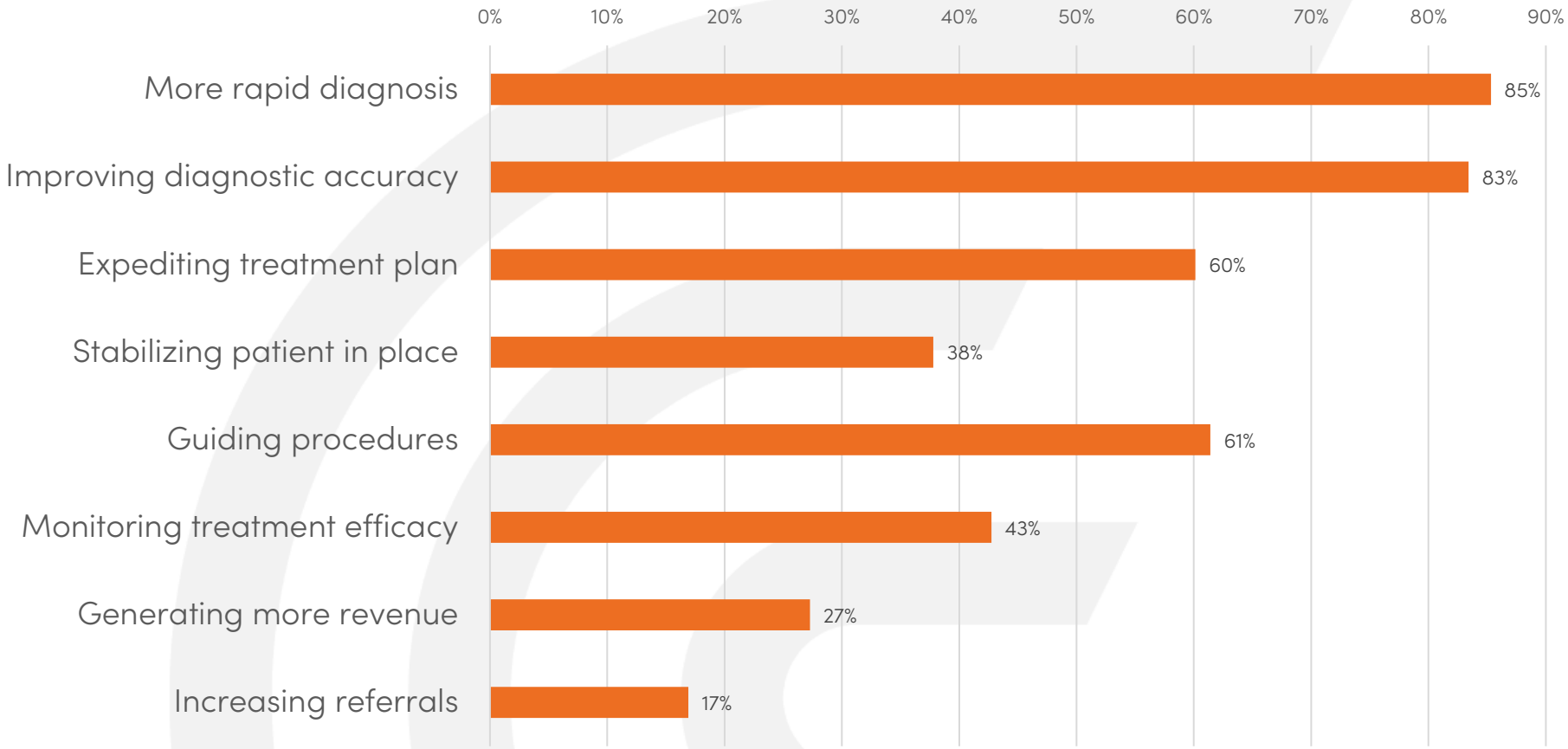
occasional series on feline abdominal ultrasonography, discusses the diseased adrenal glands. Aimed at general in feline abdominal ultrasound,

"Ultrasound examination of the adrenal glands can provide important information pertaining to several conditions including hyperaldosteronism and hyperadrenocorticism."

Griffin S. Feline abdominal ultrasonography: what's normal? what's abnormal? The adrenal glands. J Feline Med Surg. 2021 Jan;23(1):33-49. doi: 10.1177/1098612X20979509. PMID: 33403910. Source: https://pubmed.ncbi.nlm.nih.gov/33403910/

Poll

What do you see as the key advantages of using ultrasound for veterinary medicine?



Your Expert Guest Speaker

Dr. Camilla Edwards
DVM, CertAVP, MRCVS

Peripatetic Veterinary Ultrasonographer | Educator | First Opinion Veterinary Ultrasound

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Pancreas and the Adrenals

Dr Camilla Edwards DVM CertAVP MRCVS
First Opinion Veterinary Ultrasound

Conflict of interest declaration: Honorarium

Flat commission for ultrasound machines sold through my website

FOVU

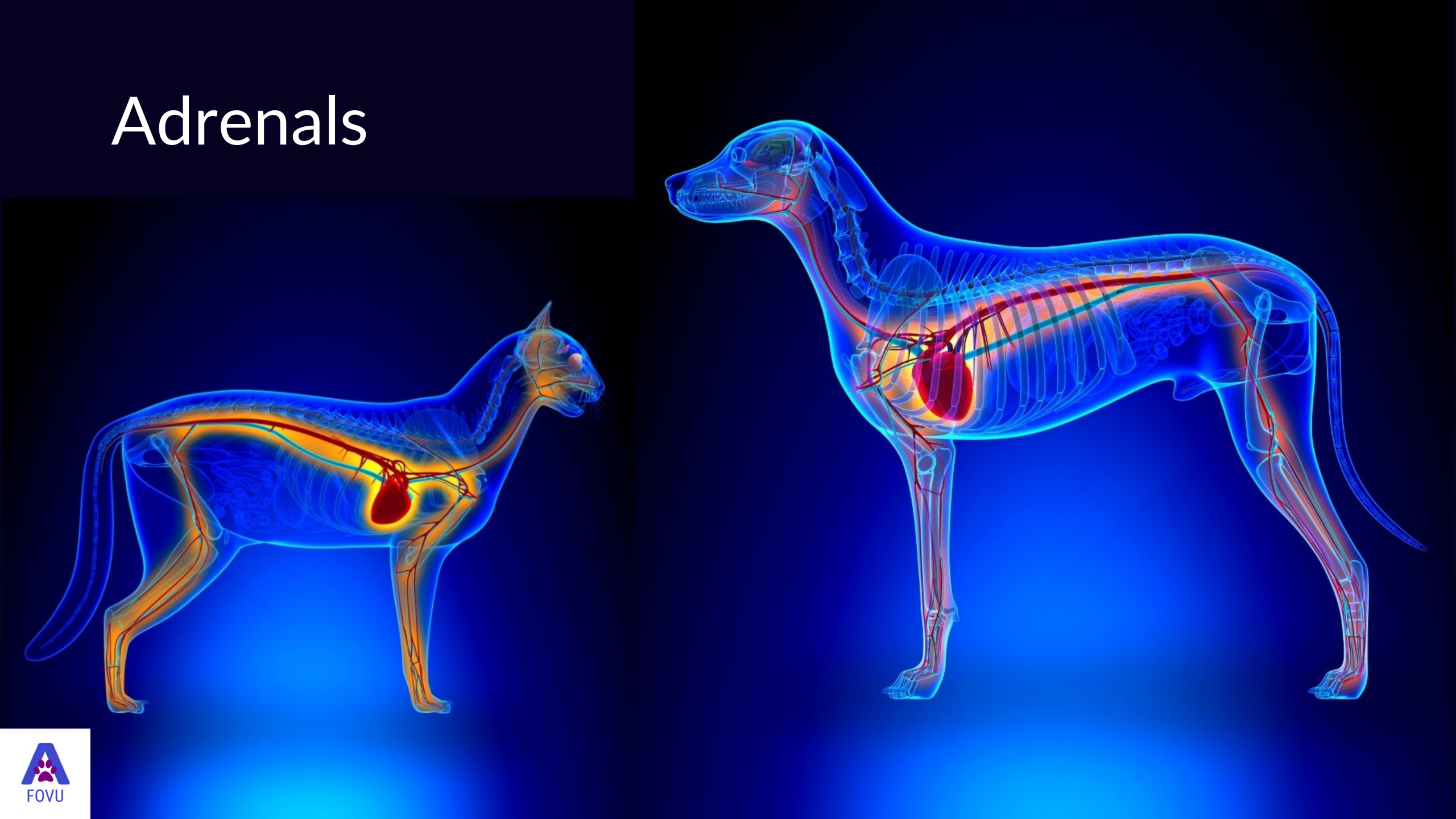
What will we learn in this webinar?

- How to find the adrenals and the pancreas
- What are the landmarks to help you consistently find these structures
- Indications for scanning these organs.
- Signs of pathology to watch out for in the adrenals and pancreas

What knowledge are we already assuming?
We're assuming you have some basic knowledge about ultrasound machine set up and basic anatomy

FOVU

Adrenals



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Adrenals indications for scanning

- Suspect or confirmed hyperadrenocorticism to differentiate between pituitary dependent and adrenal dependent disease
- Suspect or confirmed hypoadrenocorticism
- Part of the normal full abdominal ultrasound examination

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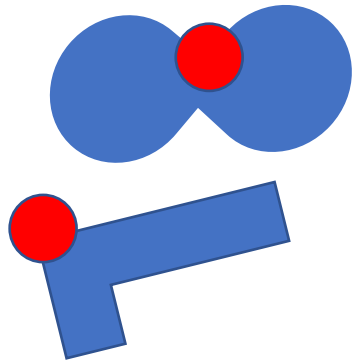
What am I looking for?

- Cats
  - Length 0.89-1.25cm
  - Cranial pole thickness 0.3-0.48cm
  - Caudal pole thickness 0.3-0.45cm
- Dogs
  - Length 1-5cm
  - Caudal pole
    - <10kg <0.54cm
    - 11-30kg <0.68cm
    - >30kg <0.8cm
- Left - peanut shaped
- Right – L shaped/arrow head
- Phrenicoabdominal vein



FOVU

Adrenals – ultrasound artifacts

Normal artefacts

- Refraction from curved surface of kidneys.
- Gas from colon and duodenum (particularly annoying on right adrenal!)

Signs of pathology

- Acoustic shadowing from mineralisation (abnormal in dogs, incidental in cats)

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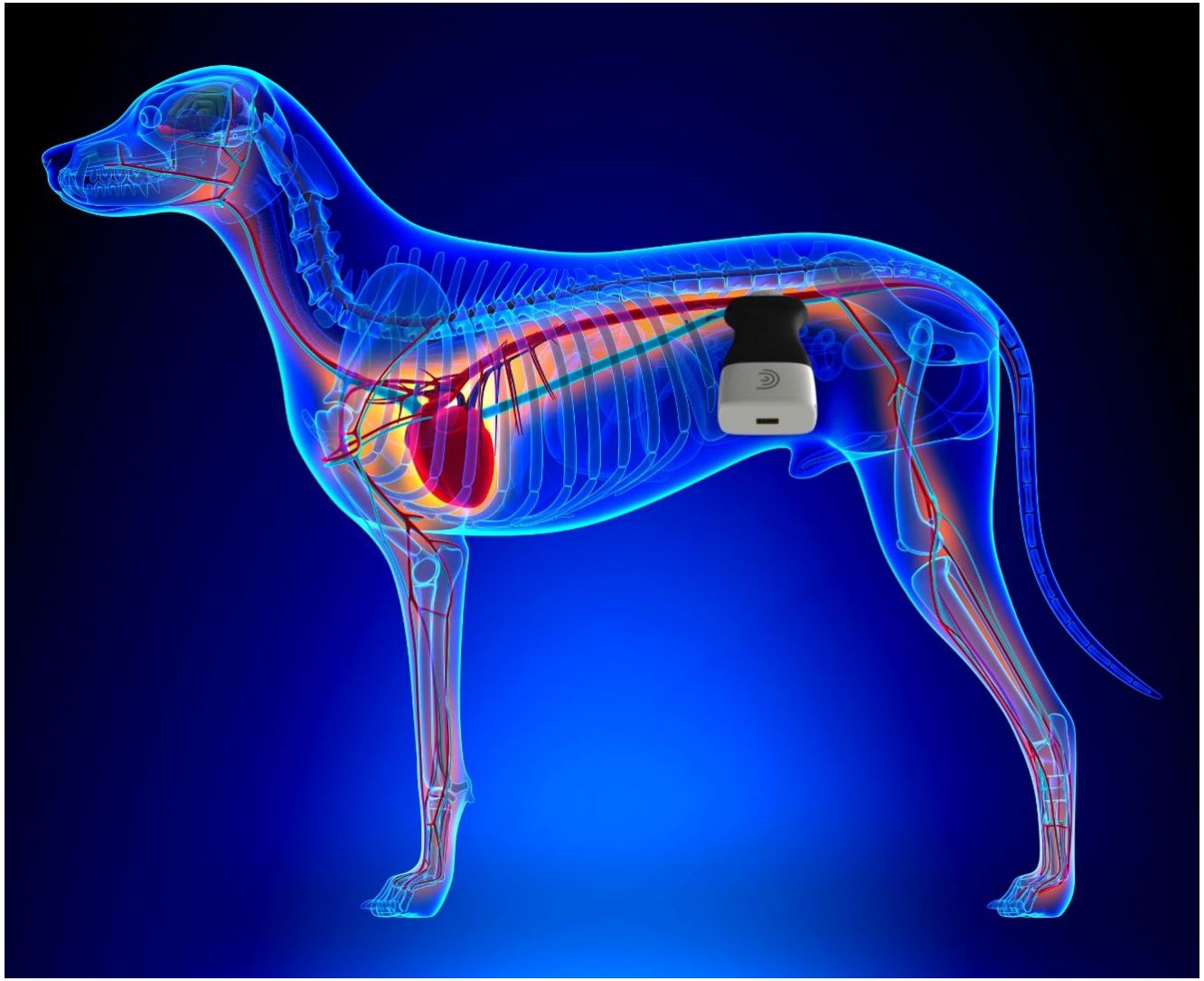
Left adrenal – how to scan

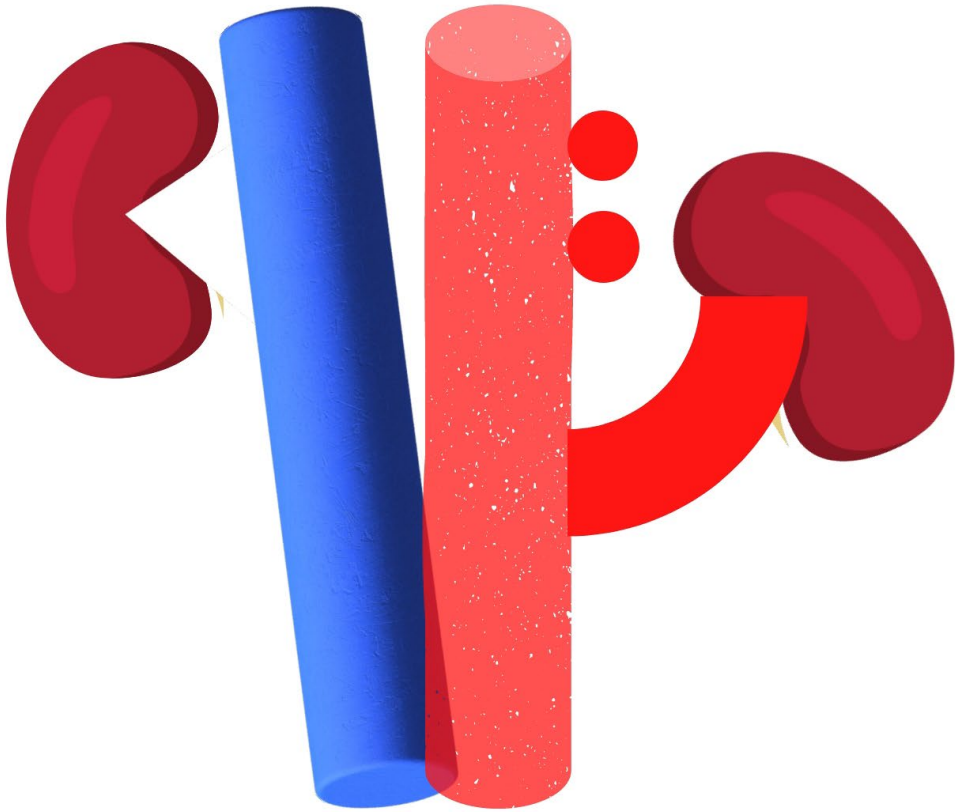


FOVU

Adrenals – How to scan video left adrenal

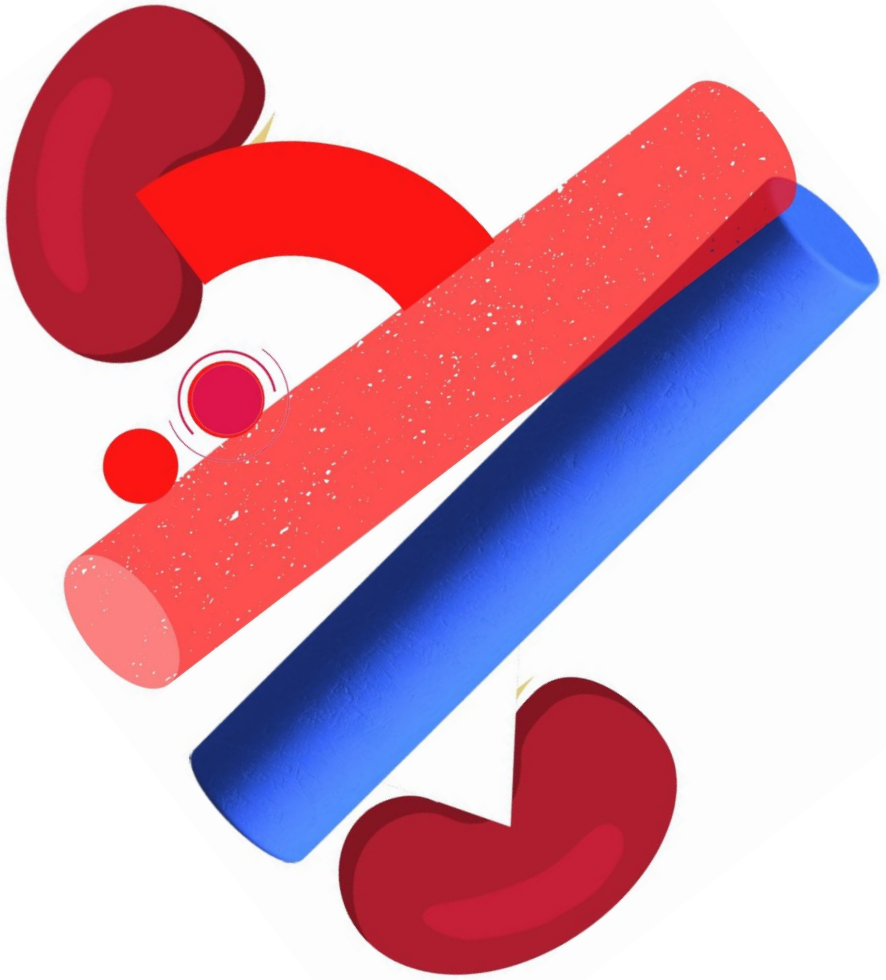
FOVU

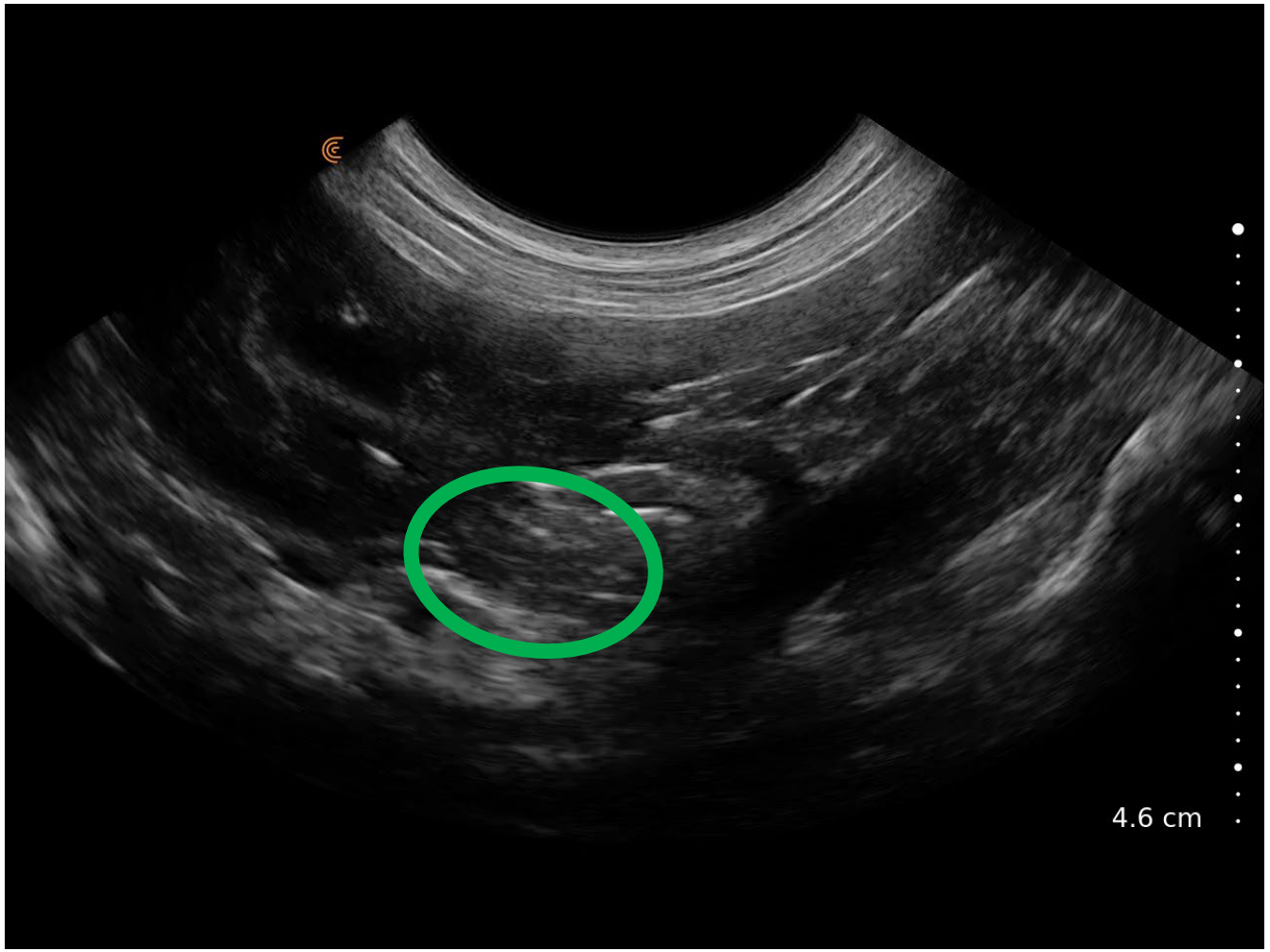
Adrenals - anatomy



FOVU

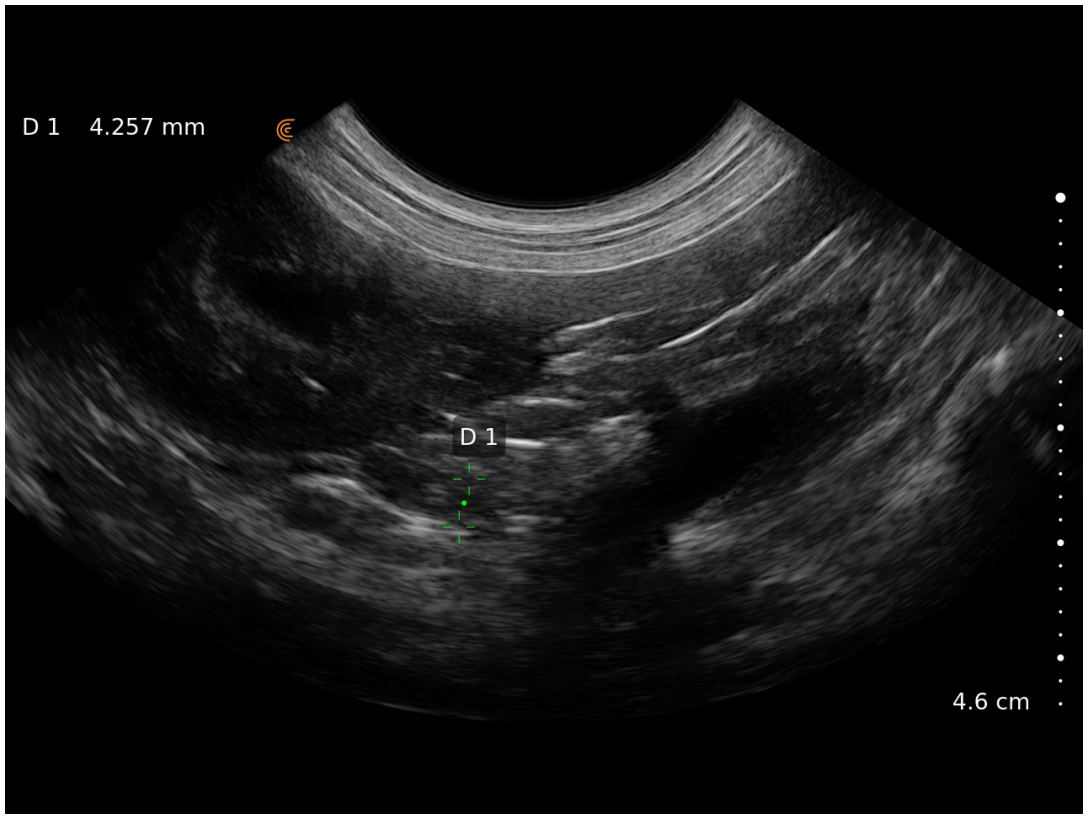
Left Adrenal





FOVU

Left adrenal – normal ultrasound images



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Left adrenal– right lateral recumbency

- Follow Aorta cranial from trifurcation in longitudinal view (probe in cranial – caudal orientation)
- A hooked artery will leave the Aorta at the level of the kidney – renal artery
- If you see 2 anechoic circles these are the cranial mesenteric artery and the coeliac artery
- Between the cranial mesenteric artery and the renal artery (often closer to the latter) fan.
- Tip – you won't necessarily have all the landmarks in one image – but when you are close to these you will find the left adrenal

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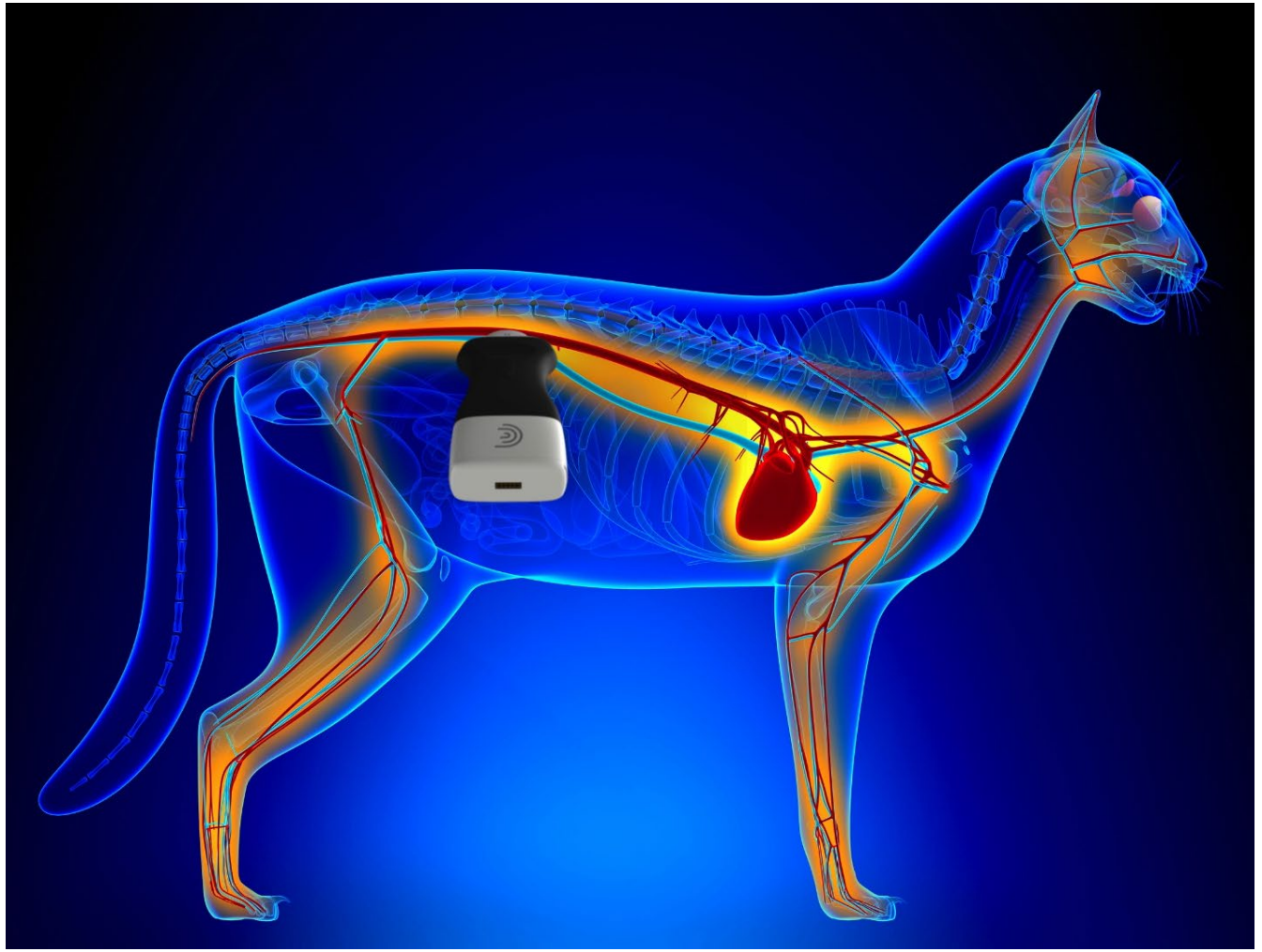
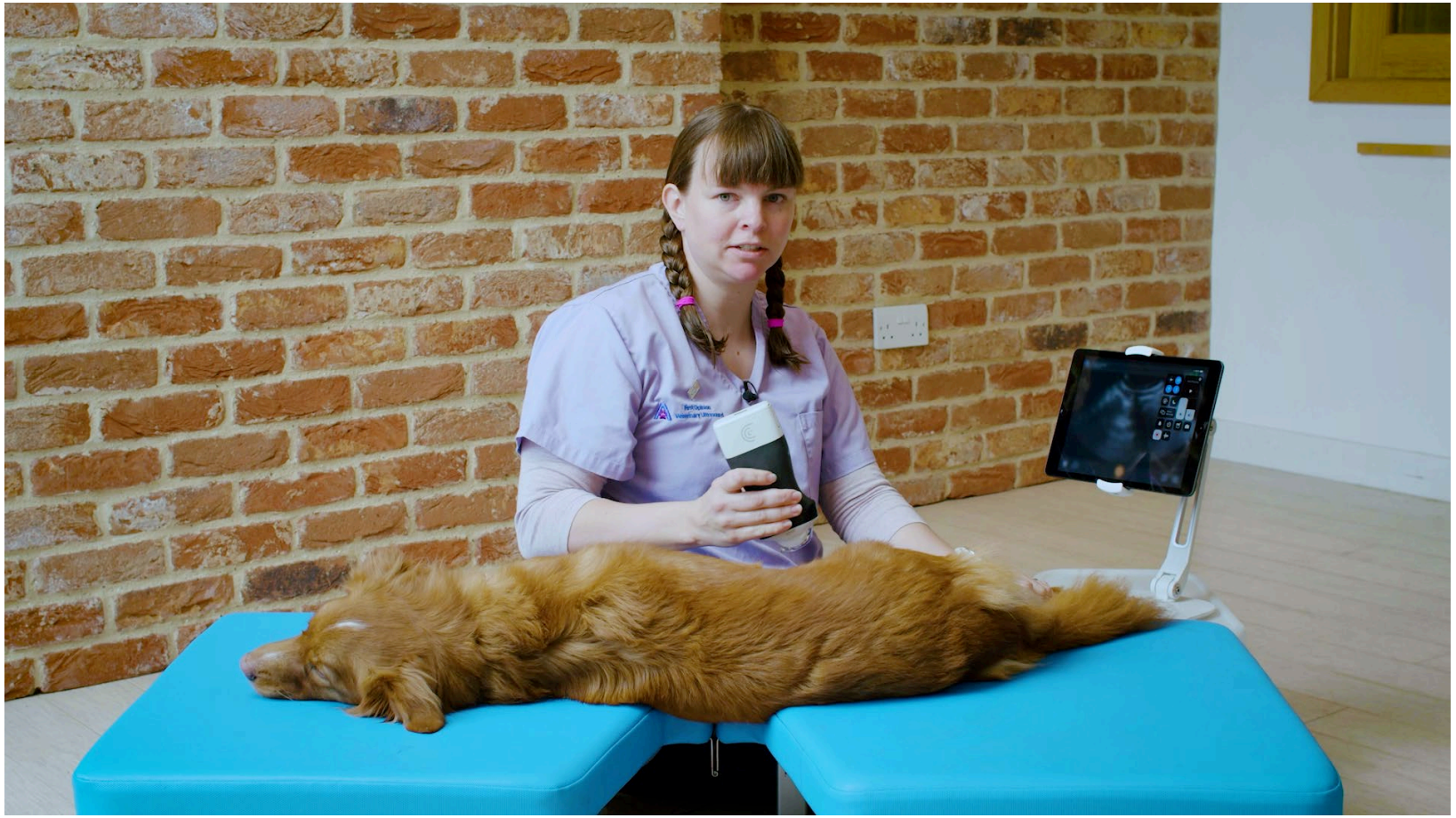
Right adrenal – how to scan



FOVU

Adrenals – How to scan video right adrenal



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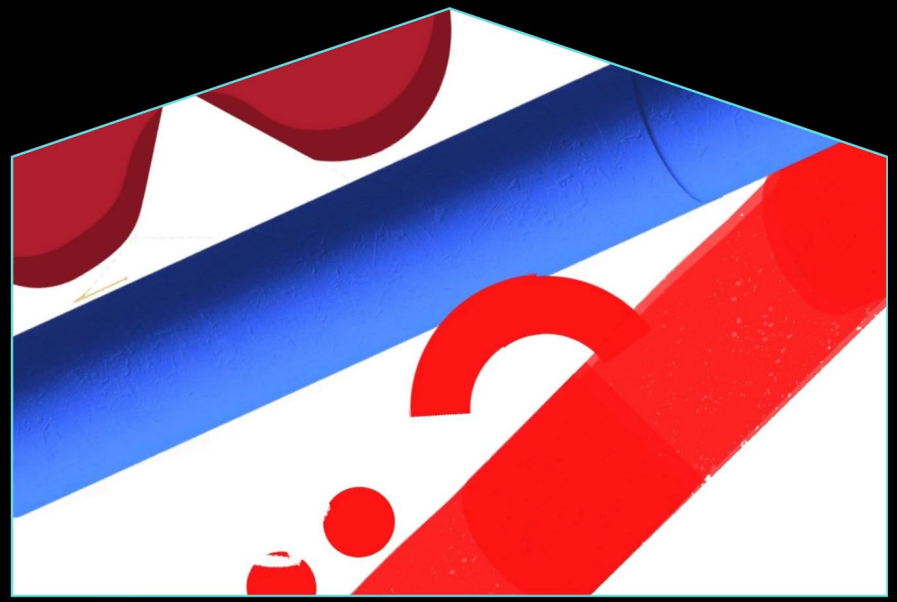
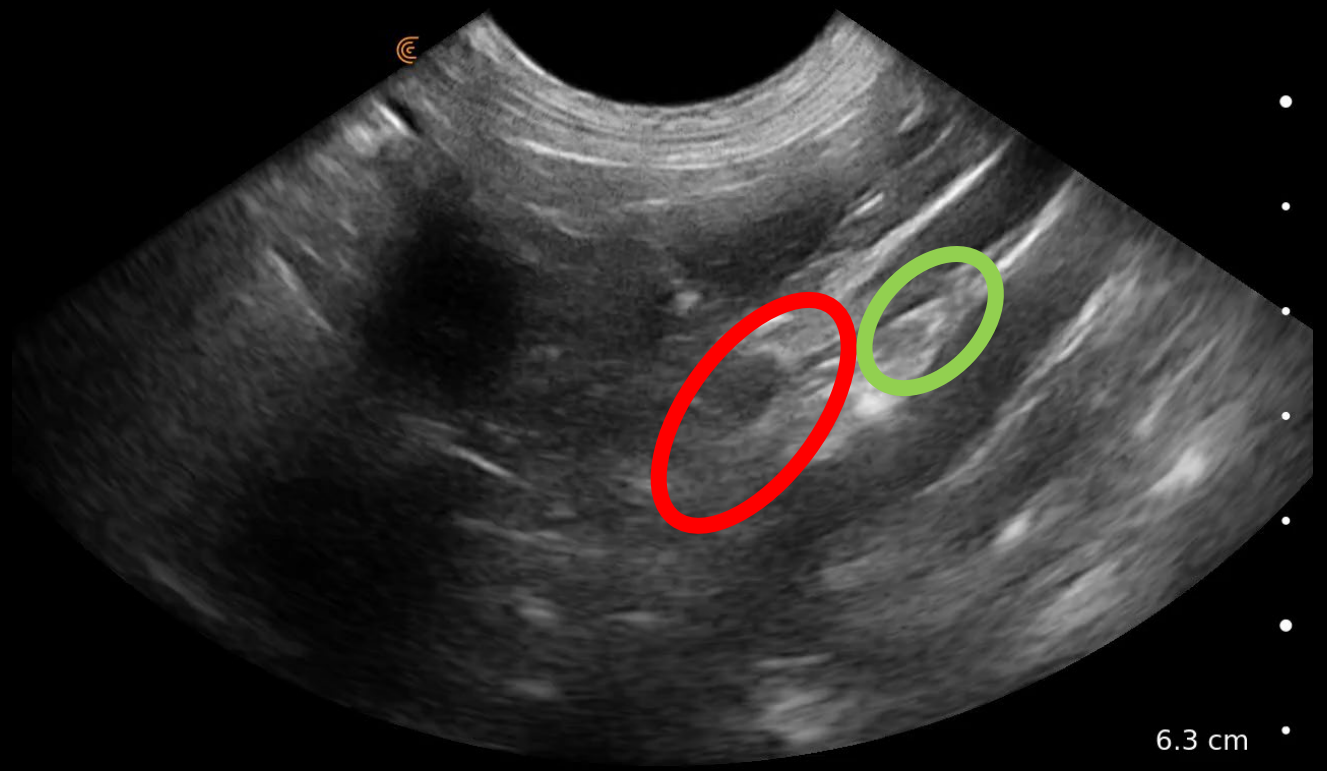
Right Adrenal





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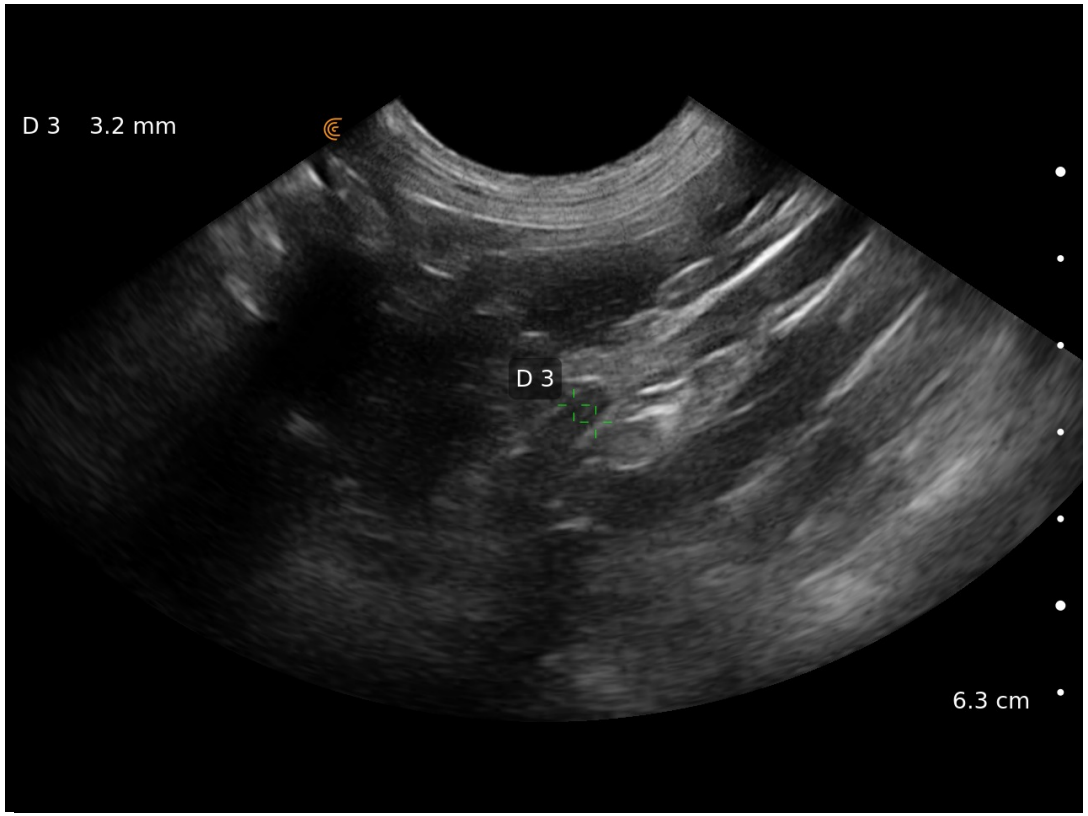
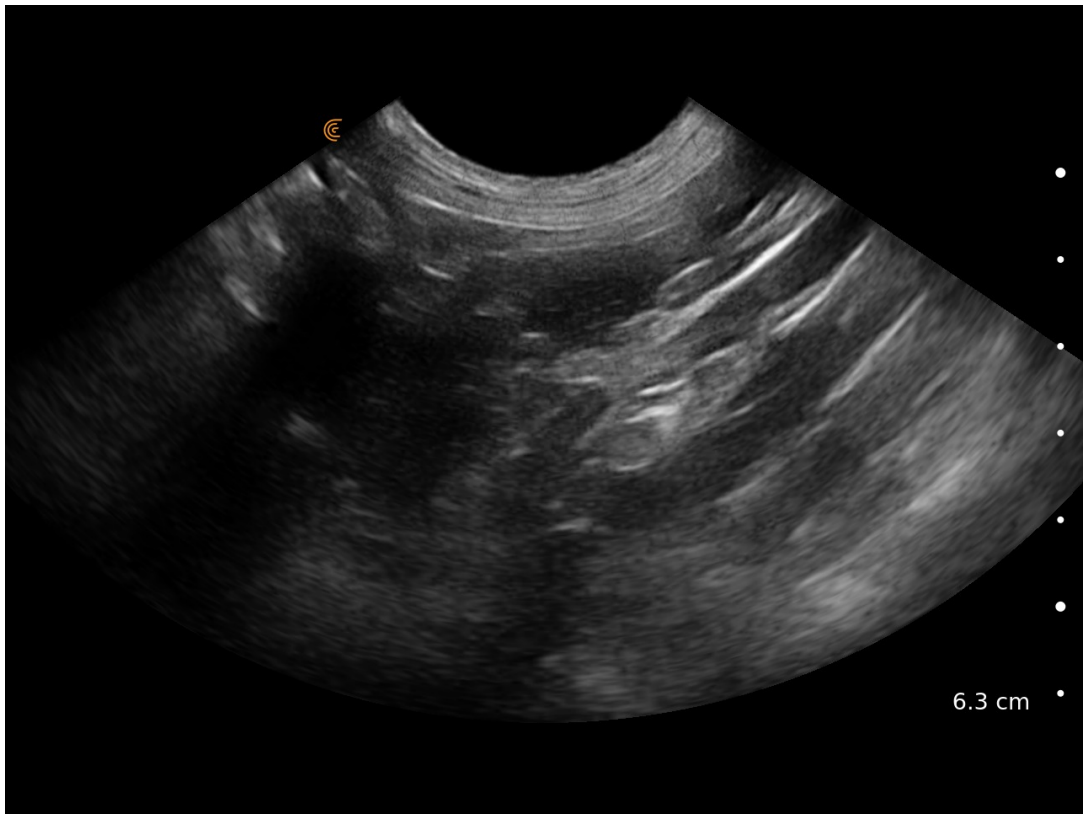
Right Adrenal – normal images





FOVU

Adrenal glands - common pitfalls

- Mistaking a blood vessel for an adrenal gland (use Colour Doppler if in doubt)
- Mistaking the left adrenal gland for the right adrenal gland (move further cranial)

FOVU

Right adrenal – left lateral recumbency

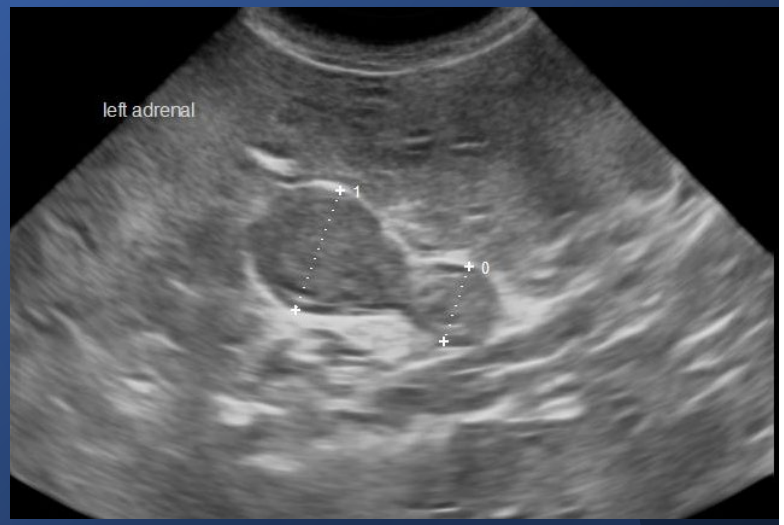
Find the CVC by scanning dorsally pointing towards spine (probe oriented cranial-caudal) and fanning.

Follow the CVC cranially – you will see it disappear ventrally away from the Aorta which continues cranial in a dorsal position.

Where the CVC descends ventrally fan between Kidney, Aorta and CVC.

The right adrenal is often very close along the CVC and is arrow shaped.

FOVU



Adrenals – Pathology

Hyperadrenocorticism

- ACTH Dependent (PDH) – 80% of cases – bilaterally normal or enlarged adrenal glands
- ACTH Independent – 20% of cases (adenoma, adenocarcinoma, phaeochromocytoma) – unilateral adrenomegaly and contralateral adrenal atrophy

Hypoadrenocorticism

- Smaller than normal

Focal enlargement

- Benign adenoma, adenocarcinomas, phaeochromocytomas
- Local vessel invasion (phrenicoabdominal vein and CVC)

Mineralisation

- Cats normal, dogs sign of malignancy

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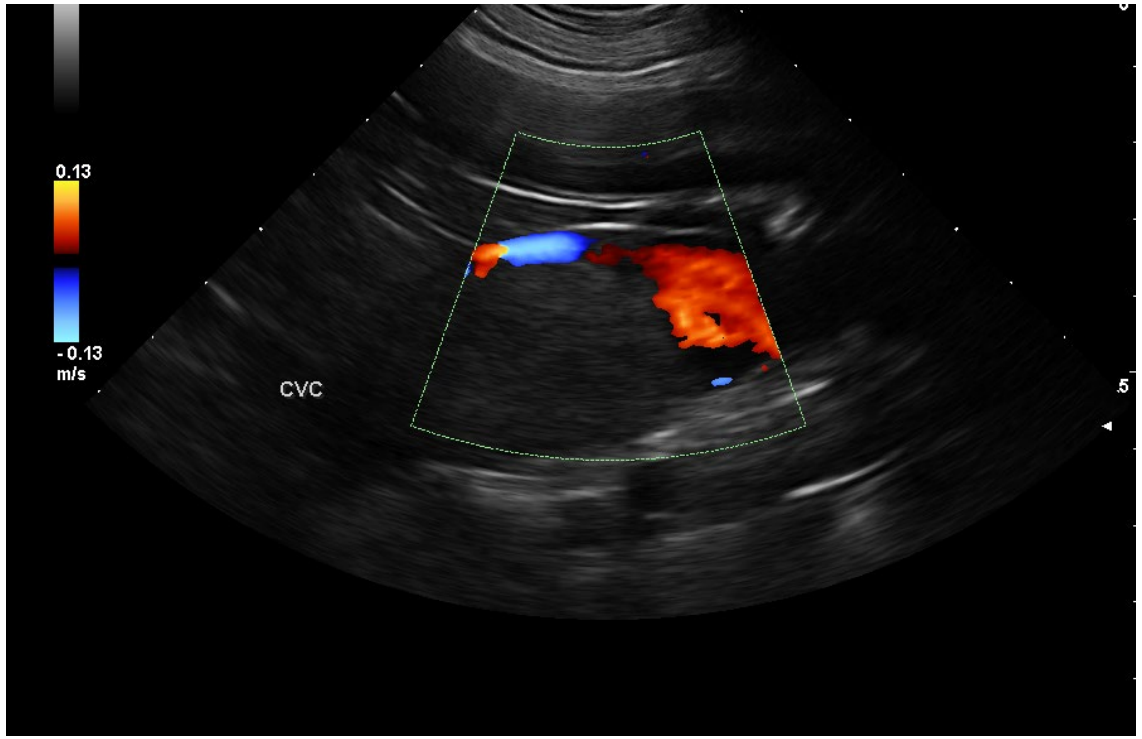
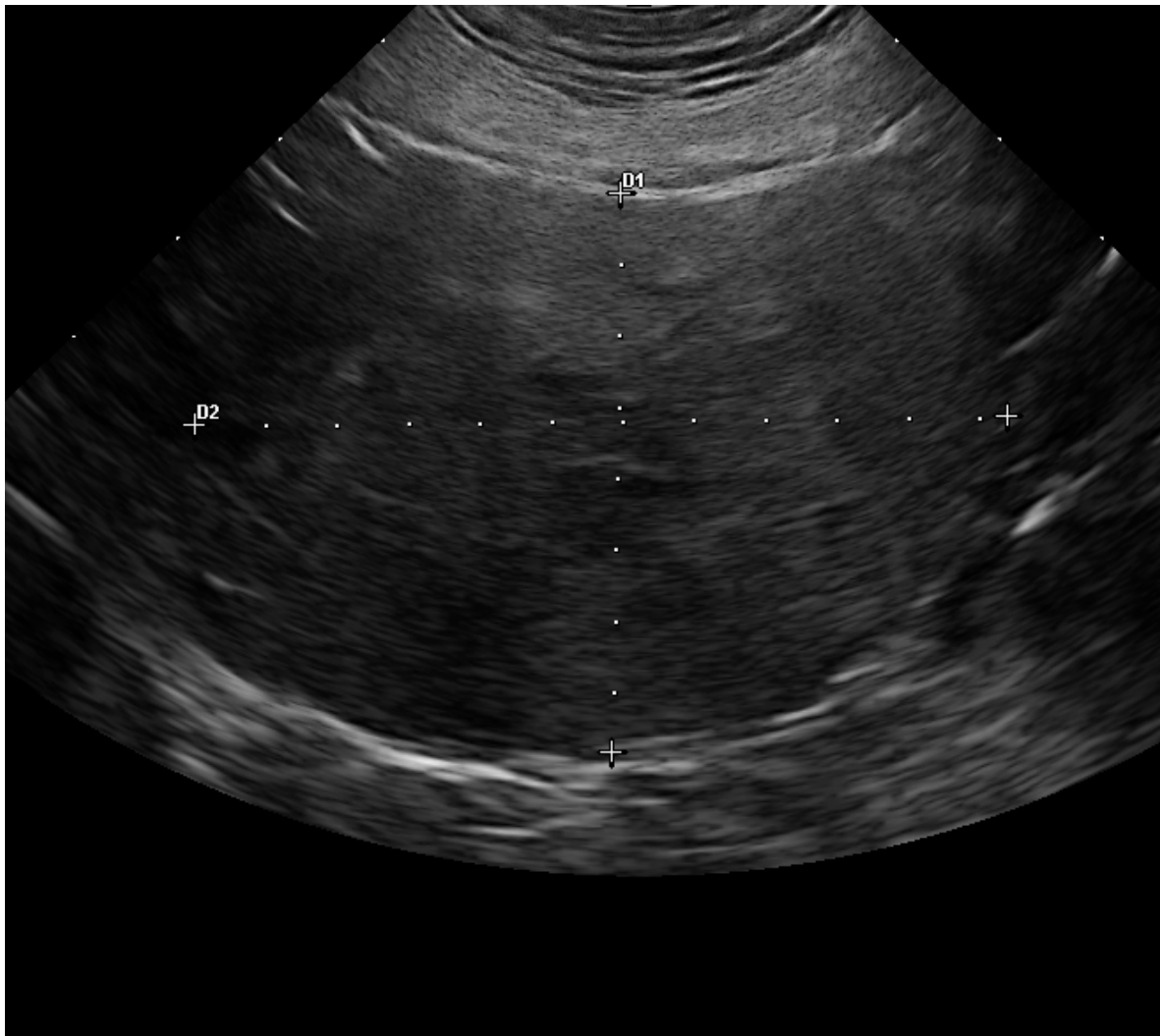
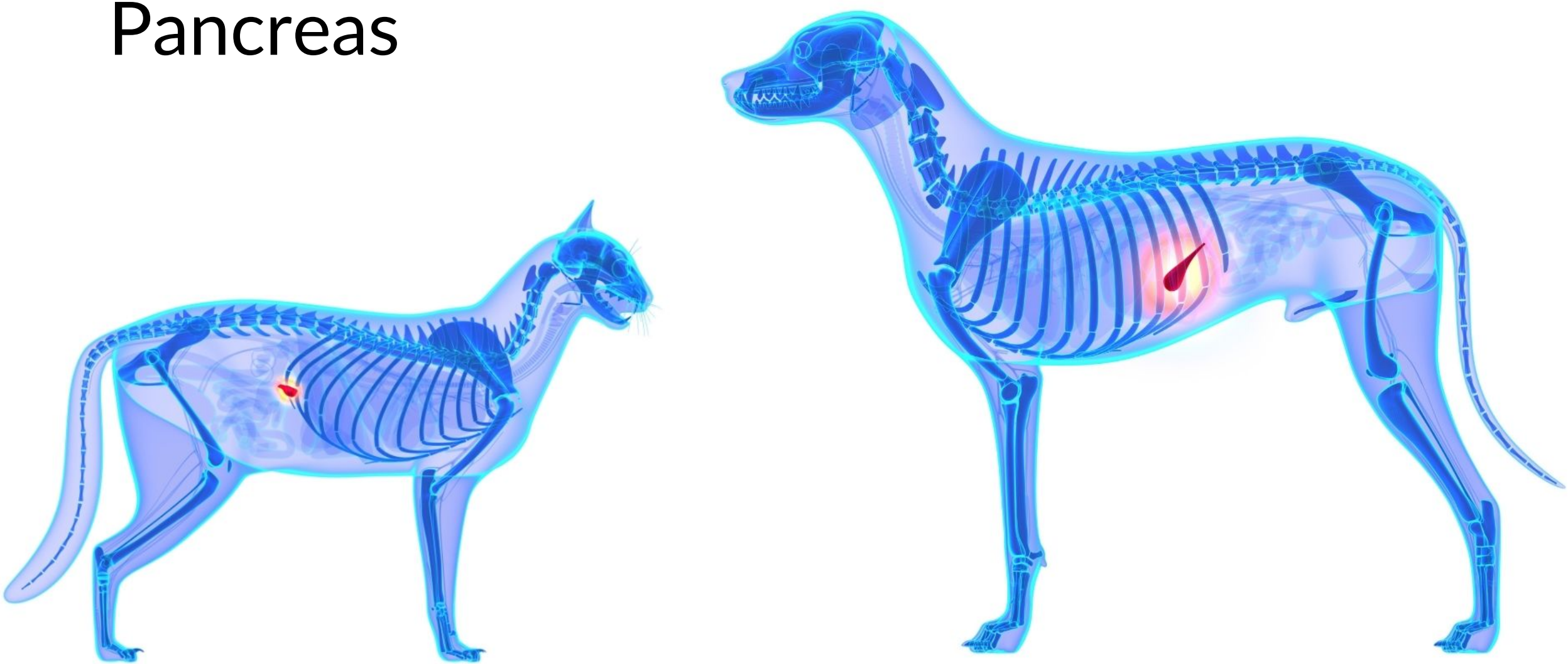
Left adrenal mass

- Rotweiller
- 6yo
- Left adrenal caudal pole 5cm invading local vasculature





Pancreas



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Pancreas - indications for scanning

- Cranial abdominal pain
- Vomiting
- Anorexia
- Lethargy
- **Pancreatitis!**

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Pancreas – what is normal?

- Size, Shape and Postition
  - Left limb (easier in cats)
  - Right limb (easier in dogs)
  - Body (hard in all!)
- Margins
  - Smooth margins
- Echogenicity
  - Isoechoic
  - Homogenous
  - Hypoechoic centre – pancreatic duct (left limb) & pancreaticoduodenal vein (right limb)
- Distribution of abnormalities
  - Try to view in two planes.
  - Important to register the mesentery/fat surrounding the pancreas for abnormalities

Pancreas – ultrasound artifacts

- Gas in the gastrointestinal tract – duodenum, transverse colon, stomach

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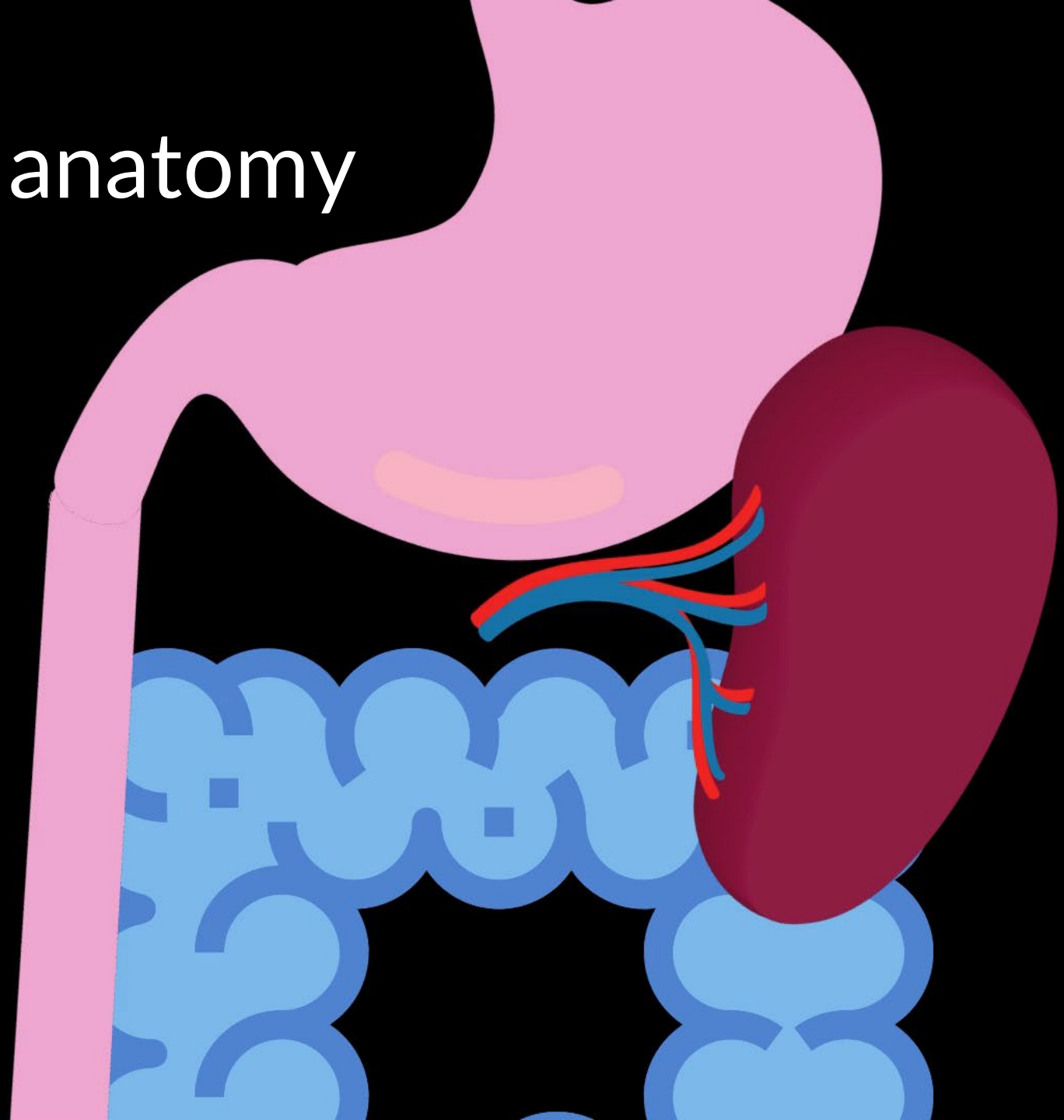
Pancreas - anatomy



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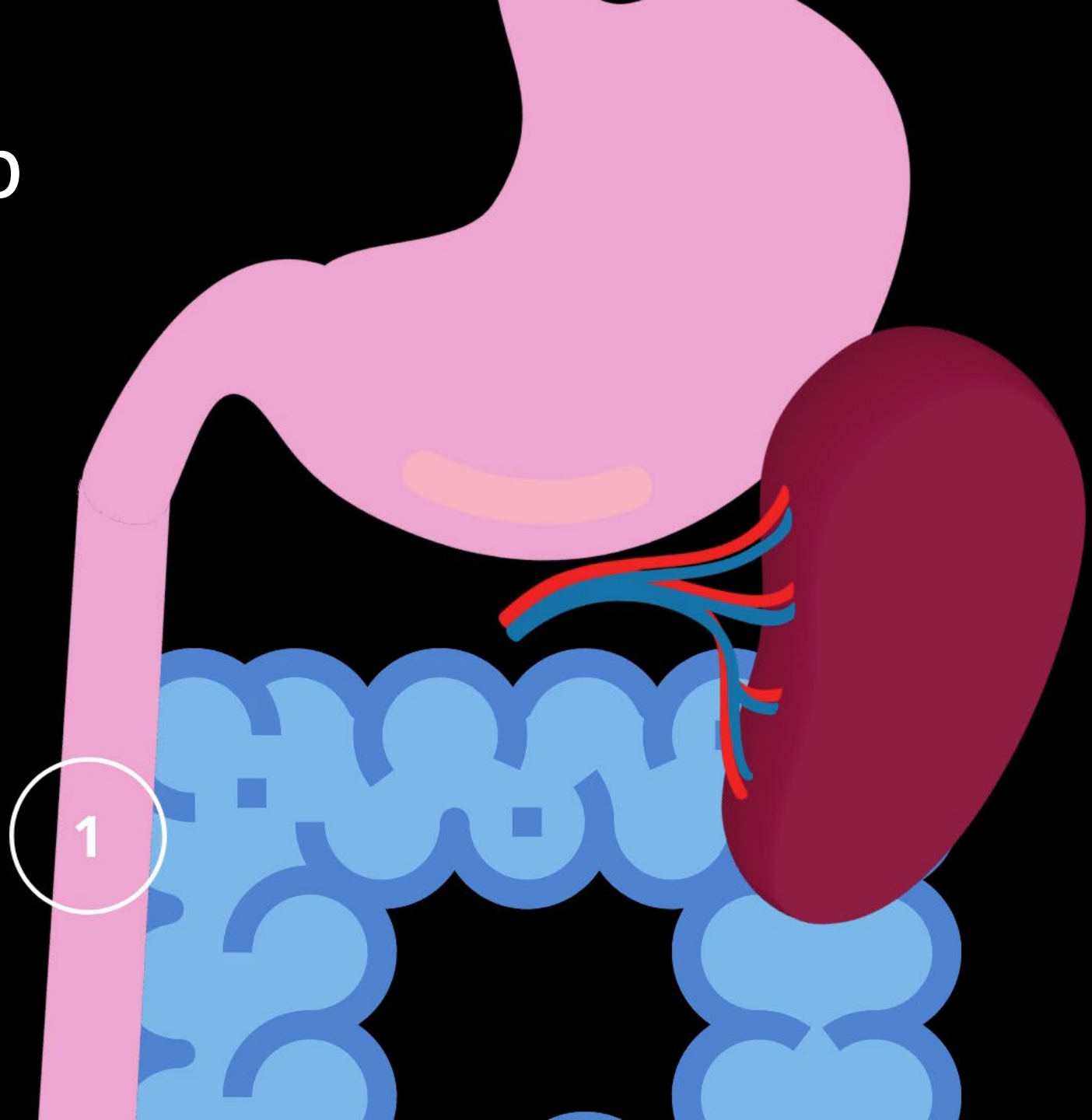
Right Limb



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Pancreas – How to scan right limb video

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Right Limb Pancreas – normal ultrasound images

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Right limb and body of the pancreas – left lateral recumbency

- Find the caudal end of the right kidney
- Pointing probe down towards table, slide ventrally
- The most dorsal, superficial, straight loop of small intestine is the duodenum
- The right limb of the pancreas lies close to the duodenum (medially)
- Follow the duodenum cranially to the pyloroduodenal junction to see the body of the pancreas between the stomach and the portal vein

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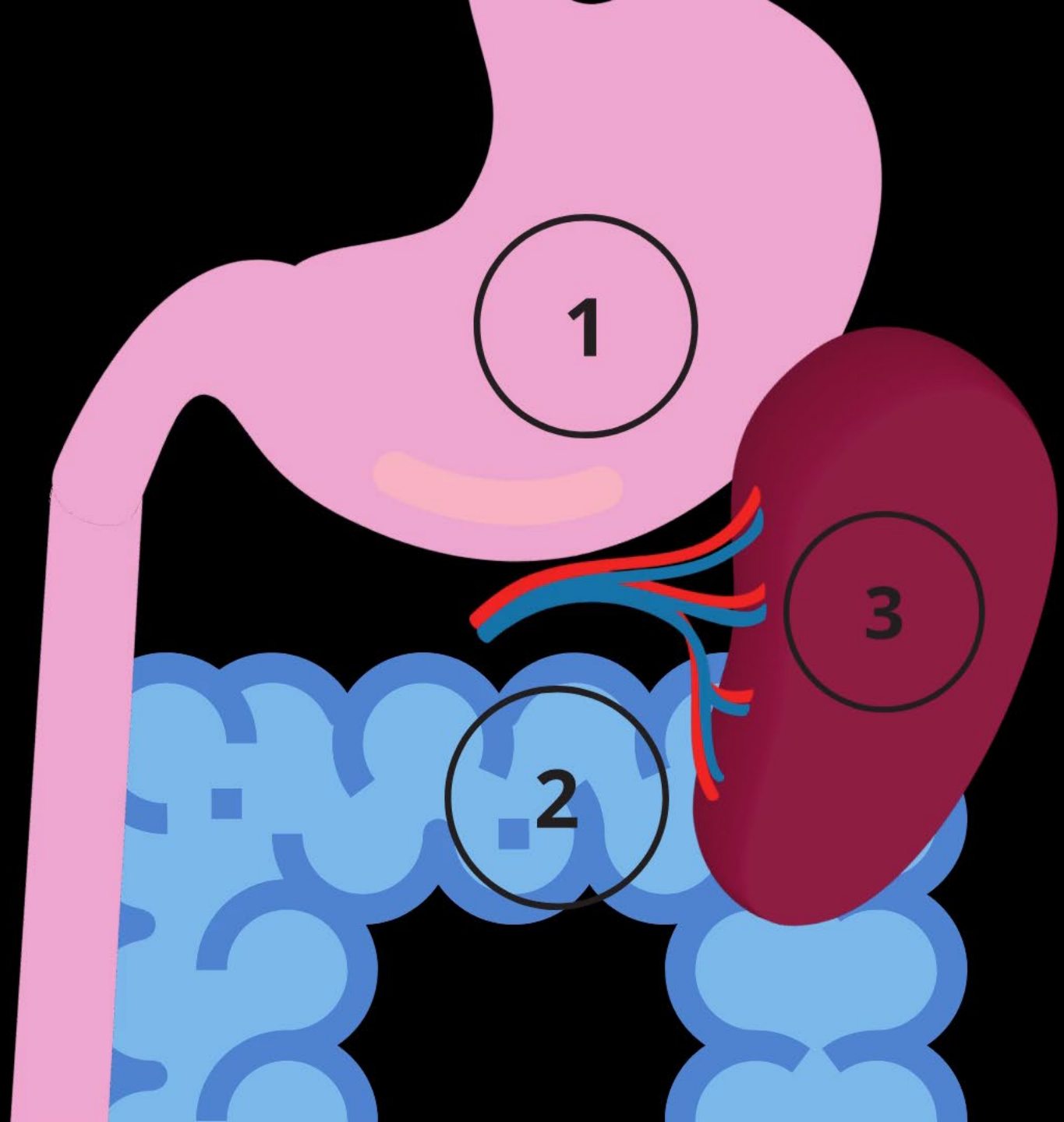
Left Limb



FOVU

Pancreas – How to scan left limb video

FOVU

Left limb Pancreas – normal ultrasound images

FOVU

Left limb of the pancreas – right lateral recumbency

- Find the colon dorsal to the bladder
- Follow the colon cranially in longitudinal view until the transverse colon is reached
- Aim to view the spleen, stomach and transverse colon in the same image
- Fan in this location particularly following the splenic vessels down to the portal vein (anechoic tubes)

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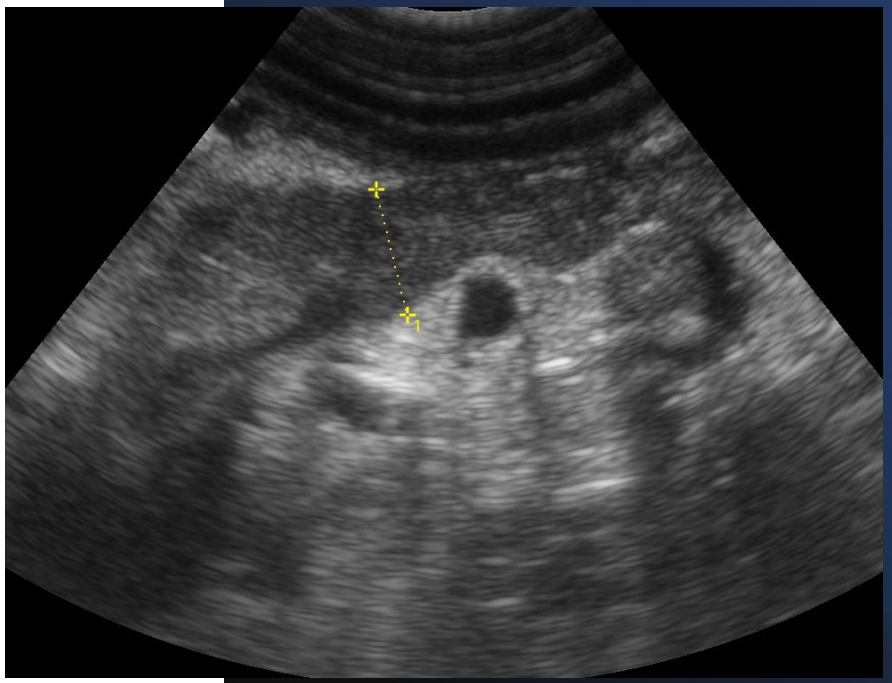
Pancreas pathology

- Pancreatitis
  - Hypoechoic pancreas
  - Hyperechoic peripancreatitic structures (steatitis)
  - Free fluid
  - Increased thickness
  - Irregular margins

THE PANCREAS BECOMES MORE OBVIOUS WITH PATHOLOGY



FOVU

How good is ultrasound at diagnosing pancreatitis?

J Vet Intern Med 2013;27:913–918

Ultrasonographic Findings of the Pancreas in Cats with Elevated Serum Pancreatic Lipase Immunoreactivity

J.M. Williams, D.L. Panciera, M.M. Larson, and S.R. Werre

Background: Pancreatitis is a common disease in cats that is difficult to diagnose.

Hypothesis/Objectives: To determine the sensitivity and specificity of ultrasonographic changes of the pancreas with serum feline pancreatic lipase immunoreactivity (fPLI) as the standard for diagnosis of pancreatitis.

Animals: 35 cats with clinical signs consistent with pancreatitis with an abdominal ultrasound examination and serum fPLI concentration measured within 3 days of the ultrasound.

Methods: Retrospective study: Pancreatic thickness, pancreatic margination, pancreatic echogenicity, and peripancreatic fat echogenicity were evaluated. Sensitivity and specificity were calculated with an elevated serum fPLI concentration indicative of pancreatitis as the standard for diagnosis.

Results: Serum fPLI was elevated and diagnostic for pancreatitis in 19 of 35 cats. The single ultrasound characteristic with the highest sensitivity was hyperechoic peripancreatic fat at 68% (95% confidence interval = 44–87%), indicating a moderate probability that cats with pancreatitis will have this abnormality on ultrasonographic examination. Specificity was >90% for each of increased pancreatic thickness, abnormal pancreatic margin, and hyperechoic peripancreatic fat. The sensitivity and specificity of ultrasound were 84% (95% confidence interval = 60–97%) and 75% (95% confidence interval = 48–93%), respectively, in cats with elevated serum fPLI indicative of pancreatitis.

Conclusions and Clinical Importance: The presence of a thick left limb of the pancreas, severely irregular pancreatic margins, and hyperechoic peripancreatic fat in cats with appropriate clinical signs and elevated serum fPLI are highly supportive of pancreatitis.

Key words: Abdominal ultrasound; Pancreatitis; Serum feline pancreatic lipase immunoreactivity.

Received: 31 August 2019 | Accepted: 19 December 2019
DOI: 10.1111/jvim.15693

STANDARD ARTICLE

Journal of Veterinary Internal Medicine ACVIM Open Access

Association between abdominal ultrasound findings, the specific canine pancreatic lipase assay, clinical severity indices, and clinical diagnosis in dogs with pancreatitis

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Abstract

Background: A clinical diagnosis (CDx) of pancreatitis includes evaluation of clinical signs, abdominal ultrasound (AUS), and pancreatic lipase. However, practitioners are using AUS to diagnose pancreatitis and are using AUS severity to guide decisions. The validity of this is unknown.

Objectives: To determine whether (1) there is a correlation between AUS, specific canine pancreatic lipase (Spec cPL) assay, and CDx; (2) individual AUS abnormalities correlate more closely with CDx than others; (3) AUS severity mirrors clinical severity indices; (4) changes in AUS can be used as a marker for changes in Spec cPL or CDx; and (5) the sensitivity and specificity of AUS for pancreatitis.

Animals: One hundred fifty-seven dogs.

Methods: In this retrospective case study, inclusion criteria were signs of gastrointestinal, pancreatic disease, or both, in addition to having a Spec cPL and AUS performed within 30 hours. Information extracted from the records included bloodwork, Spec cPL, AUS images/clips, and severity of ultrasonographic findings.

Results: AUS was weakly correlated with Spec cPL (r_s = .0178, P = .03) and moderately correlated with CDx (r_s = .379, P = <.001). Pancreatic size (r_s = .285, P = <.001), echogenicity (r_s = .365, P = <.001), and mesenteric echogenicity (r_s = .343, P = <.001) were correlated with CDx. Change in AUS was not correlated with Spec cPL or CDx changes. When pancreatic enlargement, echogenicity, or altered mesenteric echogenicity were required for a diagnosis, the sensitivity and specificity were 89% (95% confidence interval [CI] 71.8, 97.7) and 43% (95% CI 34.0, 51.6). When all 3 criteria were required, the sensitivity and specificity were 43% (95% CI 24.5, 62.8) and 92% (95% CI 85.3, 95.7).

Conclusions: AUS should not be used in isolation to diagnose pancreatitis and is a poor indicator of severity.

Abbreviations: APPLE, acute patient physiologic and laboratory evaluation; AUS, abdominal ultrasound; CAPS, canine acute pancreatitis severity; CDx, clinical diagnosis; CI, confidence interval; iCa, ionized calcium; Spec cPL, specific canine pancreatic lipase; UPASS, ultrasonographic pancreatic assessment severity score.

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What are the take home messages today?

- **Know your landmarks**
  - **RLP** – duodenum
  - **LLP –** stomach, transverse colon, spleen
  - **Body** – Stomach
  - **Left adrenal –** Aorta, renal artery, cranial mesenteric artery, coeliac artery
  - **Right adrenal –** Caudal vena cava and Aorta divergence
- **What changes are you looking for?**
  - Pancreas – hyperechoic fat, size, margins, free fluid.
  - Adrenal glands - change in size in caudal pole thickness
    - Compare the size to the contralateral gland.
    - Vessel invasion
- **PRACTICE FINDING THE LANDMARKS!**

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Thank you!

- Get in touch with any questions Camilla@fovu.co.uk
- Check out my website www.fovu.co.uk
  - Scanning
  - Reviews
  - Courses
  - Community

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Live Demonstration

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5 Ways POCUS Can Help in an Emergency

1. *Superior to radiography for the detection and scoring of of free intraabdominal fluid.*
2. *Real-time information for rapid diagnosis, prompting life-saving maneuvers.*
3. *Cageside and low impact with minimal restraint.*
4. *Safe, no shaving required and radiation sparing.*
5. *App-based POCUS is easier to learn and use.*

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Adam Behrens, VMD

Wandering Vet

“ The Clarius C7 HD microconvex scanner provides images as good as I’ve seen on large console machines. Its small size allows me to bring it with me to every appointment. In turn, I have been able to significantly increase the quality of care that I provide by diagnosing problems quickly and easily with certainty. ”

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Clarius C7 Vet HD

- *Wireless Freedom*
- *High-Definition Imaging*
- *Easy App for iOS & Android*
- *Dedicated Small Animal Presets*
- *Affordable Scanner*
- *No Subscription Fees*
- *Free Clarius Cloud Storage*
- *Free Clarius Live Telemedicine*
- *Unlimited Users*

Questions?

Dr. Camilla Edwards

Dr. Oron Frenkel

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Thank you!