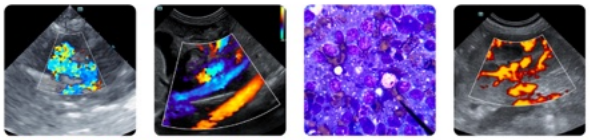

PATIENT

Macy Risser

SPECIES

Canine

BREED

Cocker Spaniel

SEX

Spayed female

AGE

14 years

WEIGHT

41 lbs

INTERPRETED BY

Eric Lindquist, DMV DABVP, Cert. IVUSS

IMAGING PERFORMED BY

Ukachi Ugorji

HOSPITAL NAME

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INVOICE

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PRESENTING CLINICAL SIGNS

- History of liver and kidney elevations
- chronic skin and ear infections
- T4 0.5 LOW 0.8-3.5 mg/dL
- Absolute Neutrophils 10857 HIGH 2060-10600 /mL
- Absolute Monocytes 1128 HIGH 0-840 /mL
- PrecisionPSL 398 HIGH 24-140 U/L
- ALK PHOS 365 HIGH 5-131 IU/L
- GGT 22 HIGH 1-12 IU/L Result Verified
- T. BILIRUBIN 0.1 0.1-0.3 mg/dL
- BUN 65 HIGH 6-31 mg/dL
- CREATININE 1.7 HIGH 0.5-1.6 mg/dL
- SDMA 22.6 HIGH <14.0 UG/dL

ULTRASONOGRAPHIC EXAMINATION OF THE ABDOMEN

Urinary System

The **urinary bladder**, trigone, and pelvic urethra presented normal thicknesses and normal tone. The ureters were not visible which is normal. No uroliths or sediment were visualized and anechoic urine was present. No evidence of inflammatory or neoplastic changes was noted. Ureteral papillae were normal.

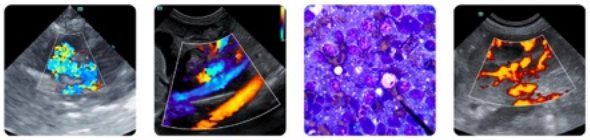
The **kidneys** were normal in size and contour with mildly increased cortical echogenicity. This is a non-specific finding. Normal corticomedullary definition was noted. The right kidney measured 6.3 cm. The left kidney measured 5.5 cm. Blood flow to the kidneys appeared adequate on color flow assessment.

Adrenal Glands

The **adrenal glands** appeared slightly enlarged and swollen. No evidence of focal capsular expansion or invasion into the phrenic veins was noted. No overt suspicion of neoplasia was noted. This is considered likely a hyperplastic change associated with stress or adrenal endocrinopathy (PDH). If isosthenuria is persistently present and the patient morphologically suggests Cushing's disease then ACTH testing would be indicated. The right adrenal gland measured 1.1 cm at the caudal pole and 1.35 cm at the cranial pole. The left adrenal gland measured 1.17 cm at the cranial pole and 0.9 cm at the caudal pole.

Spleen

The **spleen** revealed a focal, hypoechoic nodule at the mid body measuring 0.76 cm. The remainder of the spleen appeared unremarkable.



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Liver

The **liver** was uniformly swollen. The liver presented coarse architecture with mildly increased portal markings and subtle, mixed echogenic changes. This is consistent with vacuolar hepatopathy and some level of remodeling and history of inflammatory component. There was no overt suspicion of neoplasia. The gallbladder was over distended with striating bile. This is consistent with mucocele formation.

Gastrointestinal

Examination of the **gastrointestinal tract** revealed a stomach and intestine free of stasis, of normal wall thickness, acceptable curvilinear mural detail, and peristaltic activity. Small and large intestine demonstrated normal luminal chyme and stool consistency respectively. No obstructive or overt infiltrative disease was noted. No associated abnormal lymphatic activity was noted.

Pancreas

The base and limbs of the **pancreas** were observed to be largely isoechoic to surrounding omental fat. Pancreatic duct and capsular contour were acceptably normal and parenchyma respected normal curvilinear patterns. No overt evidence of active inflammatory or neoplastic disease was noted.

ULTRASONOGRAPHIC FINDINGS

Gallbladder mucocele formation.

Hypoechoic splenic nodule.

Adrenal enlargement.

INTERPRETATION OF THE FINDINGS & FURTHER RECOMMENDATIONS

Gallbladder motility study would be ideal in this patient or direct cholecystectomy given the breed predisposition to gallbladder mucocele and sonographic criteria. Subjectively the liver appears benign. The patient may present underlying Cushing's disease. If Cushingoid parameters are present then work-up for PDH is indicated. FNA of the splenic nodule is indicated. Assessment for hypertension and UTI is indicated or other causes of acute on chronic renal insult.

Efficient & Accurate Cushing's Work up-Lindquist

Notes regarding Cushing's Clinical Presentations:

Nearly all Cushing's dogs have SAP elevations and true PU/PD (USG < 1.025) and most are polyphagic.
Cushing's dogs are > 6 years and usually > 9 years old, usually have poor skin coats, body scores > 3/5, and are usually sedentary animals.

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Its important to remember that Cushing's dogs usually look and play the part and other diseases cause false + stress related cortisol spikes. On rare occasion a Cushing's dog will not follow the rules but this is truly an exception.
Potential Cushing's patient workups can be costly and frustrating if not definitive and, in my experience, the non-definitive patient usually has something else going on that may be contributing to some of the clinical signs a Cushing's dog will have, especially SAP elevations or PU/PD. Based on this prelude of information I came up with the following algorithm in the spirit of diagnostic efficiency. The following suggested protocol is based on current available literature on Cushing's disease and extensive clinical-sonographic experience evaluation + Cushing's and False + LDDST & ACTH stim. cases in order to maximize the efficiency of a Cushing's workup in practice.

Screen first, workup second

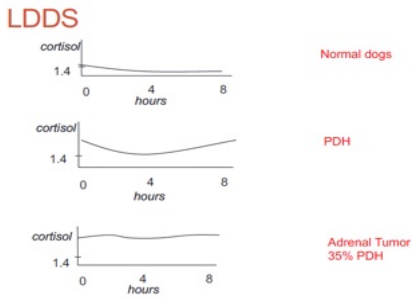
1) **UA:** Repeatable (2-3 urine samples) Urine specific gravity & urine cortisol/creatinine ratio (UCCR): If ***repeatable USG< 10.20 and + UCCR*** move to next step 2.

Note: UA is inexpensive and easy to obtain and if UA criteria is not met for Cushing's then resources can be spent into other more pertinent diagnostics or left on hold until the UA criteria is met in emerging Cushing's cases.

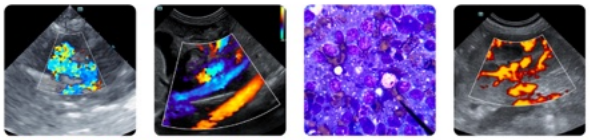
2) **Sonogram:** Does the patient **have concurrent disease** clinically or sonographically as non-Cushing's illness will influence the potential false + LDDST or even ACTH stim. The sonogram gives a global perspective of the internal health of the patient to be considered in the Cushing's workup as an assessment of concurrent disease. Is there a concurrent neoplastic process, UTI pancreatitis, mucocele….? Are the adrenals enlarged (Cushing's-PDH, stress, age related or breed variant), or atrophied (Iatrogenic Cushing's or adrenal burnout), have asymmetric enlargement (Adrenal tumor, hyperplasia, adenoma, age related variant), or is there vascular invasion (Invasive pheo with false + UA criteria or adenocarcinoma or phrenic thrombosis)? The sonogram answers these questions proactively.

Address & treat concurrent disease first before performing Cushing's testing or testing will be artificially altered increasing false negatives and positives.

3) **LDDST** (0.01 D-Sodium phosphate mg/kg IV ***with precise dosing****)*** (Better screening test but plagued with false + but considered more specific than ACTH stim) Use if there is potential early Cushing's or if adrenal asymmetry present on sonogram suspecting tumor. Use LDDST in cats at a higher dose (0.1 mg/kg IV). **Interpetation LDDST:** Look at 8-hour post first: If > 1.4 = Cushing's. Then look at 4-hour: if > 1.4 or > 50% baseline = Cushing's. 4-hour do then 8-hour spike most consistent with PDH. Flat line high constant curve without dip more consistent with tumor but can be PDH. See attached graph.



Courtesy: Rebecca Berg DACVIM, DECVIM



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4) **ACTH stim**. (Better confirming test but can have false +) Use if the patient "looks" Cushingoid or if bilateral adrenal enlargement is present, or high normal width on sonogram, or if iatrogenic Cushing's suspected (Cortisone Tx in past). ACTH stim is better for diagnosis of Addisons, Iatragenic Cushing's, and Cushing's therapy monitoring but problematic with initial Cushing's diagnosis. First dx LDDST is suggested.

5) If **diabetic** then run both LDDST & ACTH stim but stabilize as much as possible first.

5) Run a **serial blood pressure** in a BP friendly non "white coat effect" atmosphere. Run at least 3 at different times over a few hours or when eating as the patient tends to be calm when eating or give Torbutrol when entering the facility. Cushing's hypertension is usually 150-180 systolic range while pheochromocytoma range is more often > 180 systolic.

6) **Perform CT** of the pituitary to identify macro adenoma expansion if any lethargy or dullness or other central clinical CNS signs are minimally present. CT for adrenal may be more through for adrenalectomy surgical planning if ultrasound views of the CVC were problematic.

7) **Adrenectomy** for adrenal mass is prescribed then it is essential to stabilize the patient first regarding secondary disease such as organ dysfunction, hypertension, diabetes mellitus, hypernatremia, thromboembolic risk urinary and other infection in order to minimize potential for operative and postoperative complications as they are common in adrenalectomy. Trilostane stabilization therapy for Cushing's would be the first approach then address surgery and hypertension should be managed ideally < 160 systolic with ace inhibitors, phenoxybenzamine, or amlodipine.

Suggested reading:

Behrend EN, Kooistra HS, Nelson R, et al. Diagnosis of Spontaneous Canine Hyperadrenocorticism: 2012 ACVIM Consensus Statement (Small Animal). J Vet Intern Med 2013;27:1292–1304 .

Gall Bladder Motility Study

Preparation:

- Fast the dog for 12 hours before the test to ensure gallbladder is full.
- Obtain baseline ultrasonographic long axis measurements of gallbladder size in SDEP 11 & SDEP 12 positions. Long axis apex to neck, short axis at widest point.

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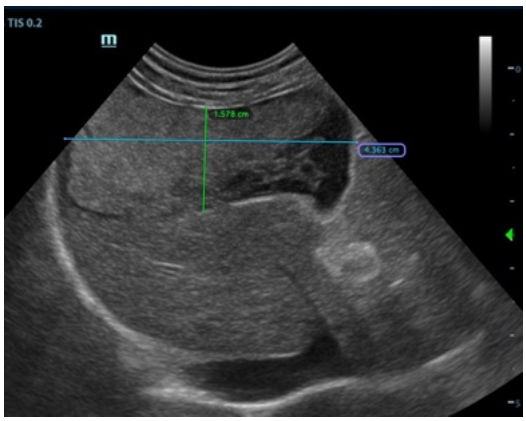


EXAMPLE IMAGE ONLY.

Meal Administration

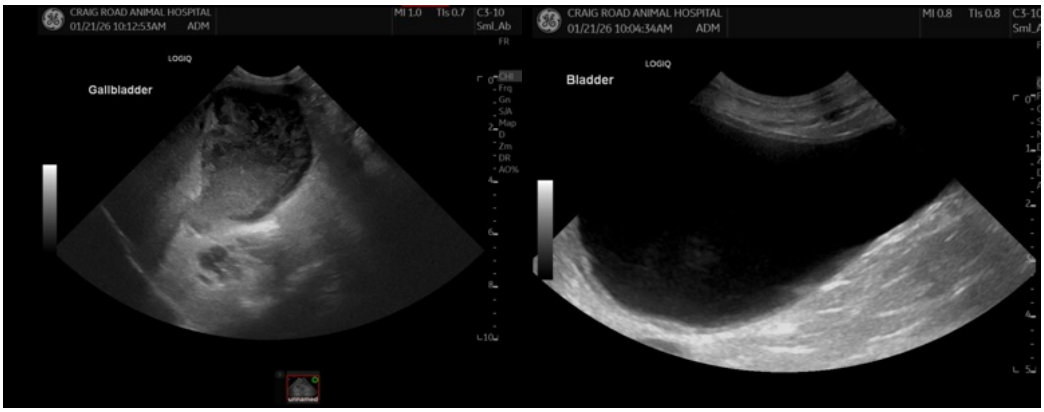
- Feed a high-fat test meal A/D diet (Hills) (*High Fat/ High Protein*)

Post-Prandial Imaging

- Perform repeat ultrasound prior to feeding (Time 0) and then at 15 & 30 minutes post-meal.
- Re-measure gallbladder volume and assess for contraction.

No change or enlargement: Possible stasis, dyskinesia, mucocele risk, or obstruction.

SonoPath is currently conducting a study for publication on this subject and contributions of image sets following this protocol are appreciated. Info@sonopath.com for more information.



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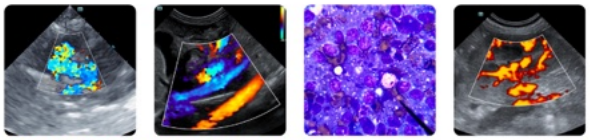

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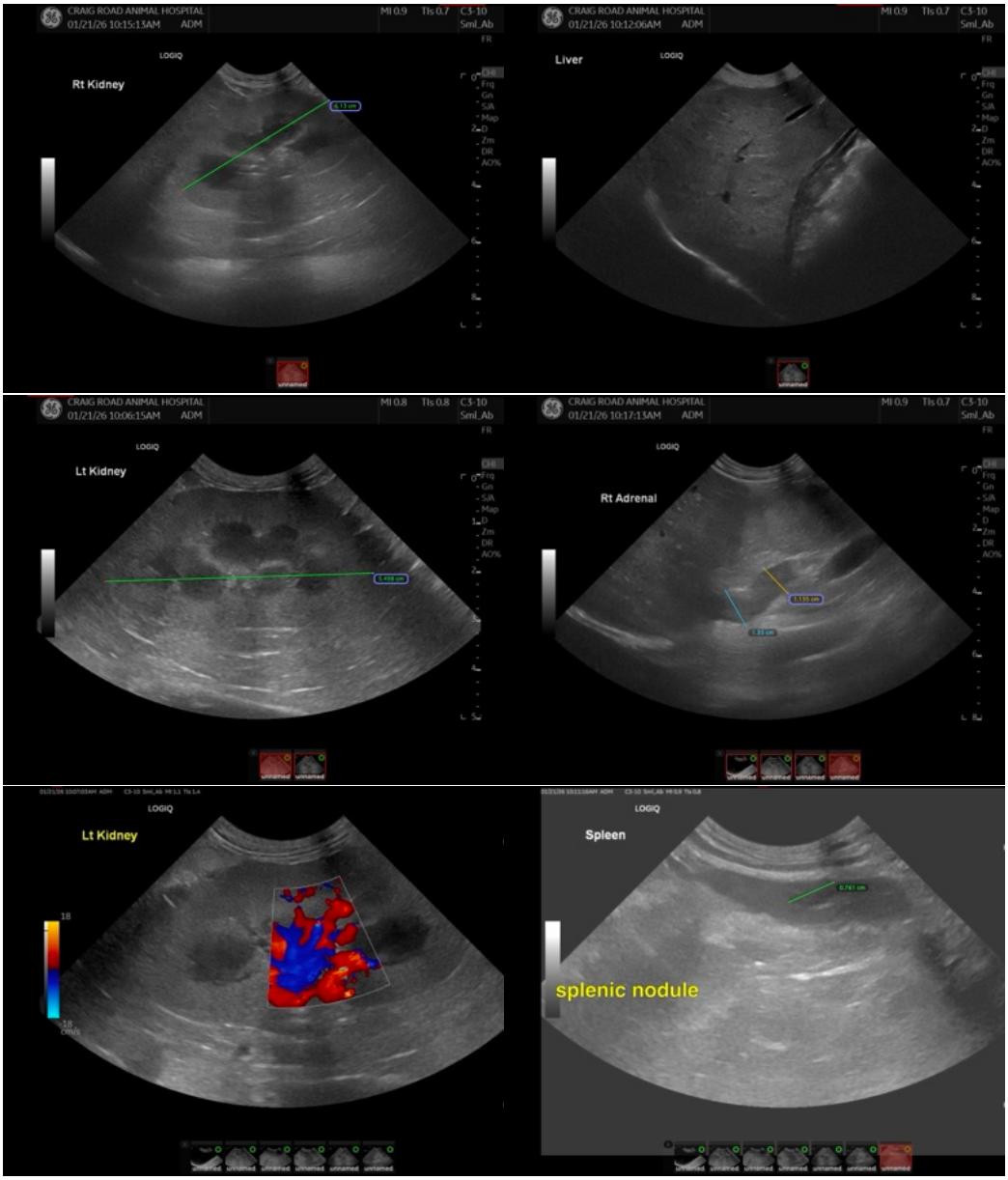

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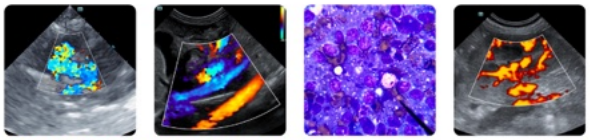

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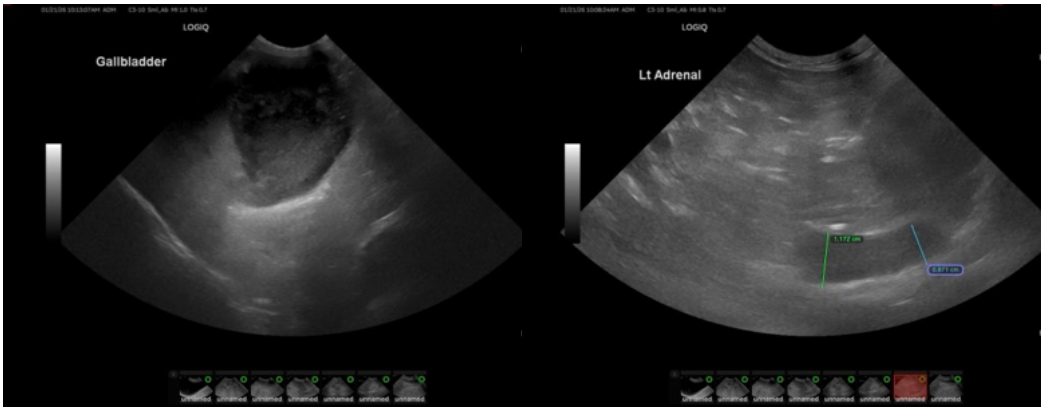

The information and recommendations provided are based on the images presented by the referring veterinarian/sonographer. No evaluation can be communicated regarding pathology that was not visible in the image/video clips provided.

Thank you for this referral. If the clinical or image interpretation does not parallel your findings or if I can be of any further assistance please contact me.

Eric Lindquist, DMV, DABVP (CFM), Cert. IVUSS, CEO of SonoPath.com

info@SonoPath.com