



**PATIENT PRESENTING CLINICAL SIGNS**

Missy Strother

**SPECIES**

Canine

**BREED**

Rat Terrier

**SEX**

Spayed Female

**AGE**

15 years

**WEIGHT**

19.4 lbs

**INTERPRETED BY**

Eric Lindquist, DMV  
DABVP, Cert. IVUSS

**IMAGING PERFORMED BY**

Sammy Burmeister

**HOSPITAL NAME**

Faith AC

**REFERRING VET**

Dr. Faith

**INVOICE**

94560

**DATE**

12/13/21

History: Hx: owner claims cough is getting worse and non-productive. Waking up at 3-4am and will have coughing fits E/D good, coughs alot after water intake Owner did try raising dissues but didn't seem to help Allergy meds didn't work No V/d noted Painful in rear legs and back so has trouble exercising for long periods and rising Owner claims hasn't noticed use of diaphragm excessively OR exercise intolerance Weight:20.6# General Appearance: BAR but wants to sit with rear legs BCS: BMI 6/9 MM/CRT: pale pink, 1.0 sec Eyes: Nuclear sclerosis OU, no conjunctivitis or discharge present Oral: No oral masses noted but moderate to severe tartar noted Dental grade:3 Skin: No parasites noted, no lesions present Ears: No debris, odor, or swelling present AU, TM: unable to visualize Heart: Normal heart rate, no arrhythmia present, pulses are synchronized, murmur noted heart base and on the left but not obvious Respiratory: Lung fields sound clear but decreased, no crackles or wheeze noted, no nasal discharge present Abdominal Palpation: Very Tense and difficult due to size, No pain palpated, Possible enlarged liver and or spleen Gastrointestinal: No Significant findings, some increase gas noted distally Urogenital: No abnormalities noted Lymph nodes: No enlargement noted, palpate normal Musculoskeletal: decreased CP in rear leg and very stiff gait but no obvious pain palpated during joint manipulation, moderate muscle atrophy present in rear legs Neurological: Normal placement of all four feet, no weakness present but shaking noted Radiographs; enlarged rounded appearance to liver and irregular spleen Cardiac silhouette enlarged with perihilar lymphadenopathy, leafing of lung lobes and increased bronchointerstitial lung pattern seems to be worsening R/O: cardiac disease, allergy bronchitis, collapsing trachea, pneumonia, lung neoplasia due to metastatic disease, open Increase Furosemide to 1/2 tab BID Continue Enalapril as recommended pending BW Rx: Azithromycin 40mg/ml - Give 2 cc ONCE daily until gone Expressed concern about neoplasia and ultrasound

**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** presented a relatively uniform cortical hyperechogenicity when compared to the renal medulla, spleen and liver. No overt masses were noted. Corticomedullary definition was nebulous and the ratio favored the cortex slightly. The ureters were not visible and assumed to be normal. These changes are most consistent with chronic interstitial nephritis yet infiltrative disease could not be entirely ruled out without biopsy though neoplasia is not suspected. Minor pyelectasia was noted along with minor, cortical microcystic changes. The kidneys each measured 4.5 cm.

**Adrenal Glands**

The **adrenal glands** were not visualized.

**Spleen**

The **spleen** was normal size and relatively normal contour with multifocal hyperechoic areas of mineralization. This is a benign change; however, can be related to Cushing's disease or other endocrinopathies.



**PATIENT**

**Liver**

Missy Strother

The **liver** revealed multi-focal, nodular changes with ill-defined margins. Increased portal markings were noted in the liver with an overt mass in the caudate process with mild disruption of architecture. The mass measured 4.4 x 4.7 cm and impinged upon the vena cava dorsally. Other nodular changes were noted within and around the mass. Irregular swelling was noted throughout the liver. The gallbladder was slightly over distended, yet without significant debris.

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**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.

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**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.

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**ULTRASONOGRAPHIC FINDINGS**

Caudate liver mass with pronounced nodular hyperplasia liver pattern.

**INTERPRETED BY**

Eric Lindquist, DMV  
DABVP, Cert. IVUSS

**INTERPRETATION OF THE FINDINGS & FURTHER RECOMMENDATIONS**

Ultrasound-guided FNA of the liver mass and general hepatic nodular parenchyma is recommended to assess if the pathologies are related. Surgical removal of the caudate process may be possible in this patient. CT evaluation for surgical planning would be ideal. Bile acid profile is also indicated. A non-neoplastic mass such as hepatoma or granuloma is possible in this case and is not necessarily malignant.

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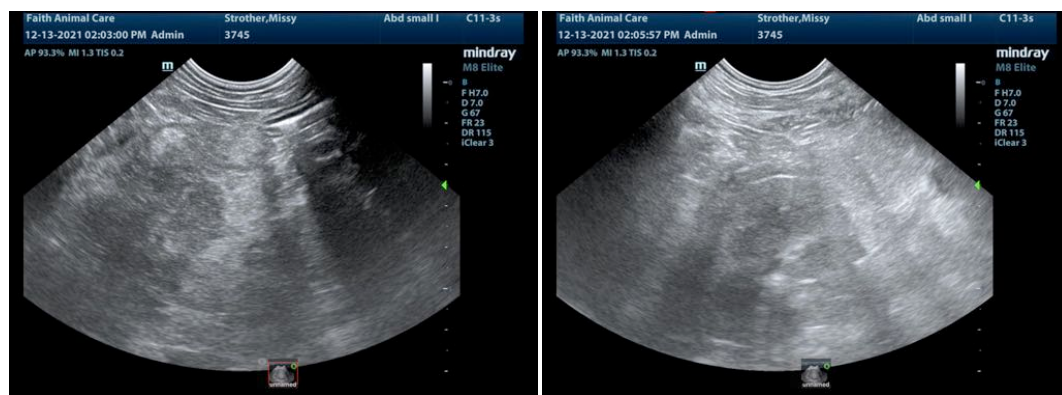
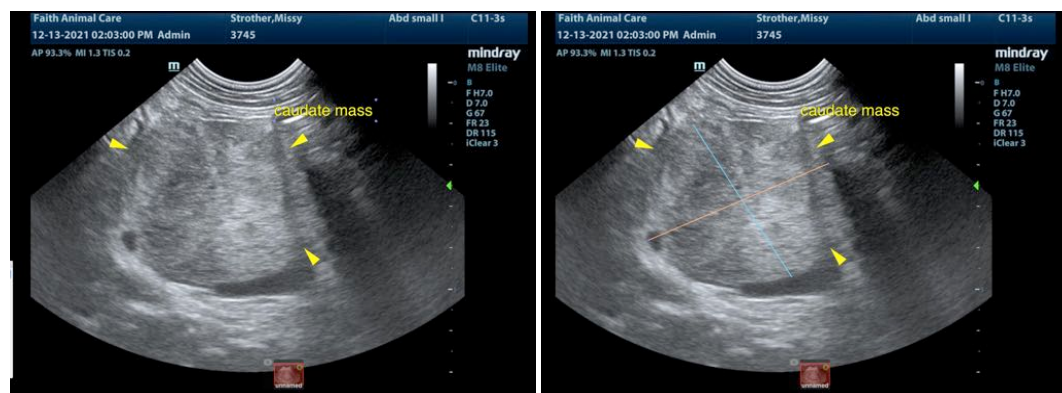
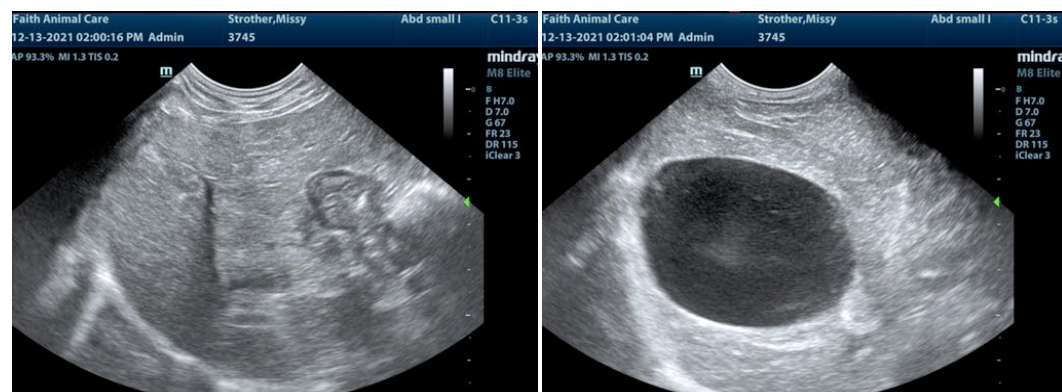
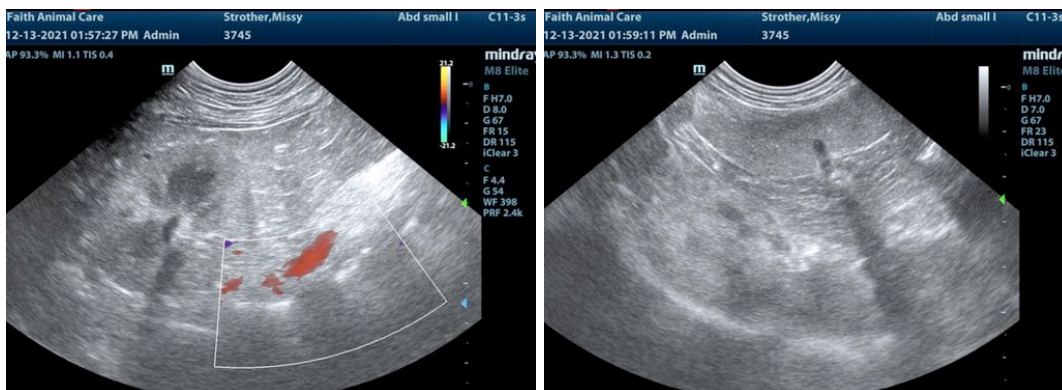
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The information and recommendations provided are based on the images presented by the referring veterinarian. No evaluation can be communicated regarding pathology that was not visible in the image/video clips provided.

**BREED**

Rat Terrier

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.

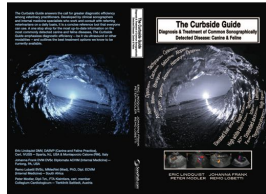
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Eric Lindquist, DMV, DABVP, Cert. IVUSS, CEO of SonoPath.com  
[info@SonoPath.com](mailto:info@SonoPath.com)

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The following is an applicable excerpt from the *Curbside Guide to Diagnosis & Treatment of Sonographic Disease* offered by [SonoPath.com](http://SonoPath.com) Lindquist, Frank, Lobetti, and Modler.

An essential quick guide for every general practitioner and sonographer.

<https://sonopath.com/products/curbside-guide-editing-due-release-12012015>

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**Hepatic Masses, Biliary Adenoma, and Biliary Adenocarcinoma**

<http://www.sonopath.com/HepaticMasses>

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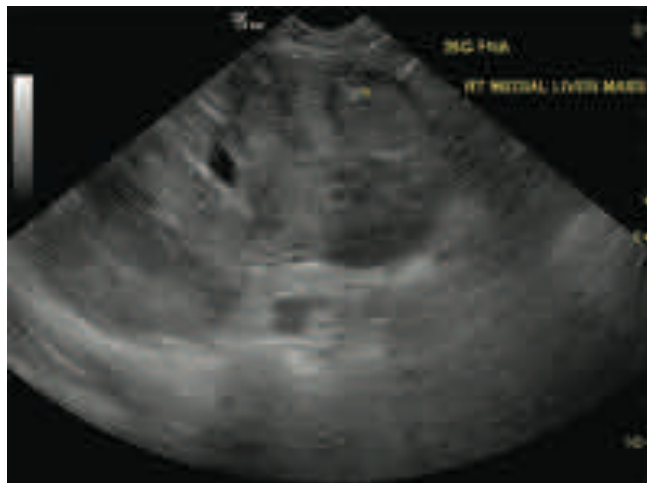
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Fine needle aspiration of a right medial lobe mass of a canine liver in subxiphoidal short axis. A large heterogenous mass lesion is seen expanding upon the liver capsule. Note the hyperechoic needle tip (arrowhead) within the mass. US- guided FNA captures cells and may not be sensitive to structural pathology or carcinoma present in the midst of vacuolar hepatopathy or nodular hyperplastic changes. Hence, the sonographer should sample a variety of echogenicities within the lesion or perform a core biopsy.

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**Description:** Hepatocellular carcinoma typically manifests in the liver's left lateral lobes, yet may cross over to the right lobes should it derive from the hilus. These masses often present cavitating, necrotic cores that are difficult to distinguish from hepatic abscesses. Vascular channels may also be involved,



<b>PATIENT</b>	and bile duct obstruction is often present. Older felines often present solitary or multiple fluid-filled cysts within the hepatic parenchyma. The latter are typically benign cystadenomas and should be differentiated from: cystic adenocarcinoma; hepatic lymphoma (usually diffusely hyperechoic +/- FIV/FeLV association); metastatic neoplasia (diffuse hyper- to hypoechoic nodules secondary to mammary adenocarcinoma, splenic hemangiosarcoma, or pancreatic or intestinal adenocarcinoma); benign nodular hyperplasia (accompanied by minimal to no symptoms); hepatic cirrhosis (regenerative nodules); or rare carcinoids, fibrosarcomas, leiomyosarcomas, and osteosarcomas.
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**Clinical Signs:** Possible clinical signs and physical exam findings include cranial abdominal organomegaly, sudden collapse associated with mass rupture, vomiting, ascites, jaundice (severe cases), and hypoglycemia secondary to a paraneoplastic syndrome. Sepsis and fever associated with secondary abscessation of the mass may also occur. Cats usually present with anorexia and lethargy.

**Diagnostics:** Routine biochemical analysis primarily shows liver enzyme elevation (i.e., ALT for cellular necrosis; SAP for hepatic congestion; elevated bilirubin for stasis/obstruction; bile acids > 75-100uM/L for significant function impairment). Staging of the disease with 3-view thoracic radiographs is essential, as is conducting a CBC, serum biochemistry, urinalysis, as well as abdominal and possibly also thoracic ultrasounds in order to provide the owner with adequate and well-informed options. Surgical and oncological referral is recommended after a coagulation panel has been assessed and ultrasound-guided biopsies of both normal and pathological tissue have been performed such that the disease is adequately characterized. In cases where surgical resection is impossible, direct chemoembolization of the tumor blood supply could be considered; however, this procedure is only performed at specific tertiary referral locations. Placement of palliative stents into the caudal vena cava (CVC) can be considered as well if compression by an unresectable tumor causes excessive ascitic fluid accumulation. Serum alpha-fetoprotein (AFP) has been shown to reemerge in dogs with malignant hepatobiliary adenocarcinoma. Ultrasound is important to localize the mass in relation to the portal hilus and gallbladder. The portal vein, CVC, aorta, gallbladder, and bile duct should all be identified with respect to the location of the mass to determine resectability. Ultrasound also allows for an examination of possible metastatic sites in the abdomen and, to some degree, in the thorax.

**Treatment:** Hepatic adenoma, hepatoma, and adenocarcinoma are usually amenable to surgical resection via hepatic lobectomy should the pathology be isolated to single-lobe progression. Multi-lobe presentation may be amenable to lobectomy and debulking; this will be determined further during surgical consultation. These tumors tend to displace unaffected parenchyma, allowing for relatively straightforward surgical resection. Up to 80% of the liver can be removed without long-term functional deficits. Blood transfusions may be necessary during surgery. The development and implementation of the LDS™ stapler has helped to streamline the procedure. Most carcinomas have metastasized by the time of diagnosis yet tend to be slow-growing; thus, it may be possible for a certain quality of life to be attained via surgical resection. Hepatic hemangiosarcoma has usually metastasized at the time of diagnosis and carries a much poorer prognosis. Surgical resection and chemotherapy are recommended, but considered by many to be an “aggressive” approach.

Preliminary trials have shown that gemcitabine is well tolerated and yields good responses in cases of hepatic as well as pancreatic, colonic, and gastric carcinomas. Myelosuppression, however, remains the key issue. Doxorubicin, cyclophosphamide, and fluorouracil combinations have also proven fruitful.

Nonsteroidal anti-inflammatory drugs (NSAIDs) have been demonstrated to have an anti-neoplastic effect due to their inhibition of COX-2 in certain tumor cells. The end product of the cyclooxygenase cascade is prostaglandin E2, which, when expressed in tumor cell lines—and not expressed in normal cells of that particular cell line—results in inhibited apoptosis, immunosuppression, and increased angiogenesis, proliferation, and invasiveness. Inappropriate increases in COX-2 expression have been documented in certain neoplasias, including squamous cell carcinoma, mammary carcinomas, prostatic carcinoma, malignant melanoma, and transitional cell carcinoma.



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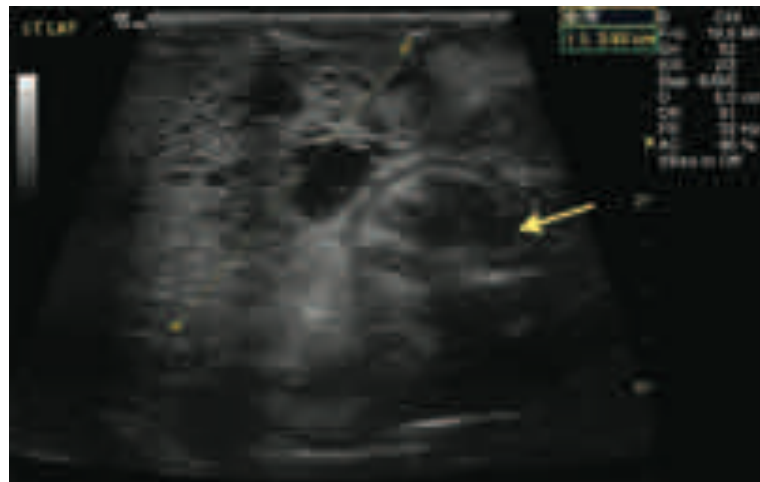
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Metronomic chemotherapy is currently being investigated and compared to traditional chemotherapy protocols; it is thought to be at least as effective as the latter with substantially less toxic side effects. Metronomic chemotherapy is the practice of uninterrupted administration of low-dose cytotoxic drugs at regular and frequent intervals, as opposed to high-dose, shorter-term protocols characteristic of traditional chemotherapeutic practices. The lower dose allows for long-term administration without toxic side effects, and has been postulated as providing longer remission intervals. Moreover, it has the benefit of minimizing the intervals between drug regimens—the period during which tumor cells may repopulate the area—as well as the chance of developing multi-drug resistant genes. Metronomic chemotherapy has been used successfully in human patients who have undergone previous chemotherapy administration. It is thought to destroy endothelial cells, thereby retarding angiogenesis and targeting regulatory T cells. To date, there have only been a few small clinical trials in veterinary patients, and these have focused on animals that have hemangiosarcoma and soft tissue sarcomas.

**Conclusion:** With respect to hepatic neoplasia, many surgical and chemotherapeutic options exist; however, it is best to consult with a local board certified oncologist who can help determine the best course of action.



Subxiphoidal long axis of the left liver in a cat with a biliary cystadenoma. Note the typical heterogenous multicystic appearance of the mass lesion displacing the regular echotexture. Acoustic enhancement is seen deep to the cystic components of the lesion. These typically benign tumors can also cause local displacement of organs such as the stomach (arrow), undergo lobar torsion, or malignant transformation that necessitate removal when this criteria is met or suspected.



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Subxiphoidal long axis of the liver in a dog with a hepatocellular carcinoma. A large irregular shaped mass lesion expanding the liver capsule is seen with echogenic fat indicative of inflammation (arrow). The lesion is highly vascularized and heterogenous. A mix of multifocal hyperechoic patches and hypoechoic nodules is seen. Anechoic areas indicate multifocal tumoral necrosis.

**References:**

Billier BJ. Teaching T cells to target tumors: towards the design of more effective cancer vaccines. Proceedings from the American College of Veterinary Internal Medicine Forum, Denver, CO, June 15-18, 2011.

Billier BJ, Guth A, Burton JH, Dow SW. Decreased ratio of CD8+ T cells to regulatory T cells associated with decreased survival in dogs with osteosarcoma. *J Vet Intern Med* 2010;24(5):1118-23.

Elmslie RE, Glawe P, Dow SW. Metronomic therapy with cyclophosphamide and piroxicam effectively delays tumor recurrence in dogs with incompletely resected soft tissue sarcomas. *J Vet Intern Med* 2008;22(6):1373-79.

Lana S, U'Ren L, Plaza S, et al. Continuous low-dose oral chemotherapy for adjuvant therapy of splenic hemangiosarcoma in dogs. *J Vet Intern Med* 2007;21(4):764-69.

Milner RJ. Do NSAIDs make a difference in cancer? Proceedings from the American College of Veterinary Internal Medicine Forum, Denver, CO, June 15-18, 2011.