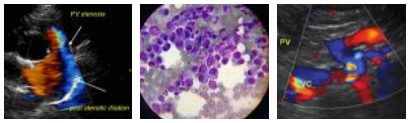
IMAGING PERFORMED BY

IntraPet.com



SonoPath
Clinical Sonography & Telecytology
EDUCATIONAL TELECONSULTATION SERVICES™
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DATE
3/4/22

PATIENT

Froggy Rumsley

SPECIES

Feline

BREED

DSH

SEX

Spayed Female

AGE

2008

WEIGHT

6.2 Pounds

INTERPRETED BY

Eric Lindquist, DMV DABVP, Cert. IVUSS

HOSPITAL NAME

Animal Emergency Hospital

REFERRING VET

Dr. Roper

INVOICE

14181

PRESENTING CLINICAL SIGNS

Presenting Complaint: Not Eating. Drinking More. Trouble Passing Stool.
History: Date: 03-03-2022 Notes: Never a large cat; coexists with owners--not overly friendly. ATO last week, husband noticed wt loss (able to see spine). Mrs started monitoring her close - last defecation on Sat. Has not seen her defecate outside of litter box or in it since Sat - decreased appetite over last few days. O tried to offer wet, she licked the gravy. Yesterday did not eat - increased thirst
Assessment: Problems: -Icterus -Not eating -Weight loss -Lethargic.
DDX: Hepatic lipidosis vs Hepatitis vs Cholangiohepatitis vs Cancer.
Current Medications: Vitamin B Complex Injection (Per mL), Buprenorphine 0.6mg/mL, Maropitant Citrate (Cerenia) 10mg/mL Solution Injection, Pantoprazole (Protonix) 40mg/vial Injection, and Metronidazole 5mg/mL Injection.

Lab Results: Attached.
Date of Previous IntraPet Ultrasound: No previous.
Sedation: Not required to complete full diagnostic ultrasound.
Stat Report: Not requested.

Imaging Performed By: Rachel Brilhart, RDMS.

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 were noted. Ureteral papillae were normal.

The **kidneys** revealed largely normal size and structure, corticomedullary definition and ratio (cortex 1/3 of medulla) were essentially maintained with some moderate age-related loss of curvilinear patterns regarding the capsule and C/M junction. The cortices presented largely uniform texture with some increased echogenicity expected for his age patient. Medullary structure differed distinctly from that of the cortex and no evidence of pelvic dilation was present. Slight mineralization was present in the kidneys. The left kidney measured 3.5 cm. The right kidney measured 3.79 cm.

Adrenal Glands

Both **adrenal glands** were visualized and recognized as having normal shape, size, position and echogenicity for this breed. The phrenic vasculature, glandular echogenicity and detail were unremarkable. Capsule, cortex, and medullary definition were normal for this age patient. The left adrenal gland measured 0.45 cm. The right adrenal gland measured 0.51 cm. Slight pinpoint mineralization noted.

Spleen

The **spleen** presented a smooth homogeneous parenchyma hyperechoic to liver and renal cortical parenchyma. The capsule was smooth without noticeable expansion or deviation from within the spleen or adjacent pathology. The splenic vasculature demonstrated normal volume without signs of congestion or thrombosis. No sonographic evidence of acute or chronic inflammatory, neoplastic, or infarctual changes were noted.

Liver
The **liver** was diffusely hyperechoic to falciform fat. Parenchyma was uniform. Lipidosis with inflammatory pattern likely. Possibility of underlying lymphoma. The gallbladder and common bile duct were unremarkable.

Gastrointestinal
The **gastrointestinal tract** revealed minor variable thickening and echogenic submucosal changes most consistent with low grade end result of chronic GI disease such as IBD and may be related to malassimilation of nutrients if any weight loss is present. No obvious neoplastic patterns were noted and luminal content as unremarkable.

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.

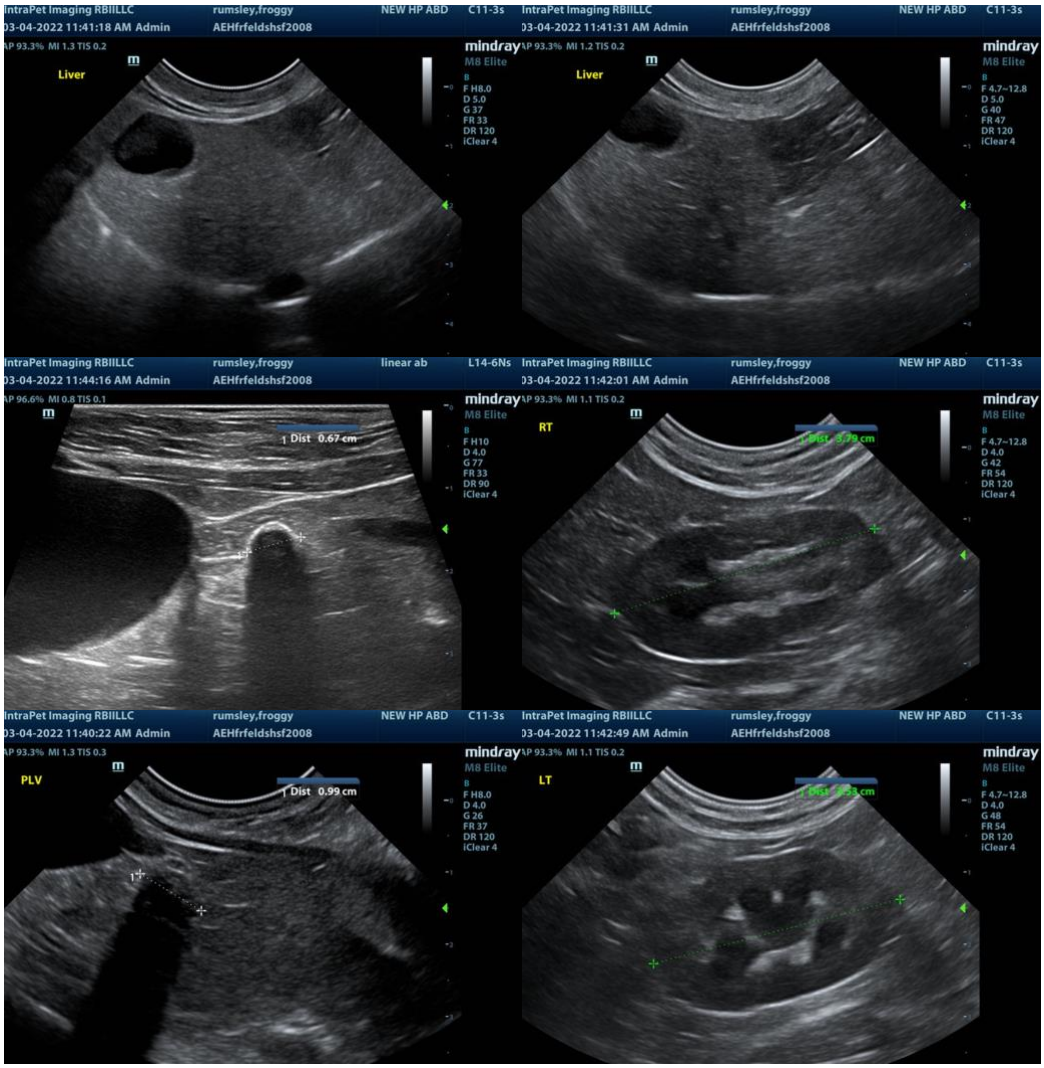
Free Abdomen
Bates Body noted in the caudal **abdomen**, adjacent to the cystourethral junction, measuring 1.0 cm, not pathological.

ULTRASONOGRAPHIC FINDINGS

- Nonpathological bates body in the pelvis
- Hepatic lipidosis with inflammatory hepatopathy pattern, possibility of underlying neoplasia/lymphoma
- Age-related renal changes with mineralization
- Age-related GI changes

INTERPRETATION OF THE FINDINGS & FURTHER RECOMMENDATIONS

Coagulation panel and 25-gauge FNA warranted to ensure underlying lymphoma is not an issue. CBC path review warranted given the anemia. Bone marrow aspirate would be ideal in this patient given the anemia. Anemia of unknown origin.



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.

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, Cert. IVUSS, CEO of SonoPath.com
Eric.Lindquist@SonoPath.com

Causes of Anemia

http://www.sonopath.com/Anemia

This chapter addresses and summarizes frequent and clinically pertinent aspects of anemia. For a more in-depth discussion of anemia, we recommend consulting a hematology textbook.

Description: Routine CBCs often reveal anemia. Ascertaining whether the anemia is regenerative or non-regenerative is key to determining the subsequent workup. Regenerative anemias, which are typified by the loss or destruction of red blood cells (RBCs), can be due to toxins, infectious agents, neoplasia, or primary immune-mediated hemolytic anemia (IMHA); GI ulceration, coagulopathy and trauma are also possible causes. Common toxins include: zinc, acetaminophen, methimazole, benzocaine, propylene glycol, methionine, and onions. These toxins typically create a Heinz body anemia, which is visible in peripheral blood smears. Common infectious agents include feline leukemia virus (FeLV), *Mycoplasma hemofelis*, *Cytauxzoon felis*, *Bartonella* spp., *Ehrlichia* spp., and anaplasmosis in cats, and *Babesia* spp. and *Ehrlichia* spp. in dogs

Non-regenerative anemias are the result of decreased RBC production and can be brought on by the following: chronic iron deficiency; anemia of chronic disease; chronic kidney disease (CKD); primary bone marrow disorders; neoplasia; and immune-mediated destruction of precursor cells (pure red cell aplasia). Infectious agents, such as FeLV, can also cause decreased erythrocyte production.

Clinical Signs: Anemia can result in weakness, lethargy, inappetence, pale mucus membranes, and audible murmurs. If hemolysis is concurrent, jaundice may be noted upon physical examination. Fever may also be present. Other clinical signs may be referable to the underlying cause, such as polyuria and polydipsia, in cases of CKD.

Diagnostics: A CBC together with a bone marrow biopsy and ultrasound-guided splenic aspirates provide a complete database regarding a patient's anemic state. Unfortunately, biopsy and ultrasound-guided aspiration are greatly underutilized in practice. Regenerative anemia is defined by the presence of a high number of reticulocytes and macrocytosis. Practitioners should always keep in mind that acute blood loss and hemolysis will not show a regenerative response for 2-4 days subsequent to the inciting event. Feline reticulocytes are punctate and larger than in dogs, and normally circulate in high numbers. Reticulocytes should be separated into aggregate and punctate as each represents a different stage of maturation. Aggregates evolve into punctate retiuclocytes; these represent the mature form and have a longer life span. Thus, cytology reports regarding RBC regeneration must include the two different numbers otherwise they are of no value. Polychromasia reflects bone marrow erythropoiesis 3-7 days earlier; the magnitude indicates the strength of erythropoiesis. A peak regenerative response is present 7 days post blood loss.

Assessing the RBC count alongside other parameters can yield a more informed etiological picture of the RBC loss:

Total solids low + anemia = blood loss
Total solid normal + anemia + hyperbilirubinemia/hemoglobinuria = hemolysis
Total solids low + anemia with PCV < 20 = acute blood loss

It is normal for healthy cats to have up to 10% Heinz bodies in circulation. Differentials for an abnormally high number of Heinz body formations may include: the presence of propylene glycol in fish-based diets; onion powder in baby food; acetaminophen toxicity; diabetes mellitus; hyperthyroidism; lymphoma; and other oxidative processes, such as naftalene (i.e., moth ball) ingestion.

Dogs may be predisposed to Heinz body anemia because of zinc toxicosis (i.e., the ingestion of coins, metals, paints), which causes hemolytic anemia and gastric ulcers. Heinz bodies are characterized by residual hemoglobin—otherwise known as “clown noses”—on their cell surface. Although Heinz bodies are always abnormal in dogs, cats can display a small percentage of them, which may be an incidental finding.

RBC morphology may indicate an underlying etiology:

- Schistocytes result from vascular turbulence and may indicate hemangiosarcoma, disseminated intravascular coagulation (DIC), iron deficiency, congestive heart failure (CHF), or glomerulonephritis.
- Acanthocytes are seen in cases of hemangiosarcoma, glomerulonephritis, and liver shunts.
- Poikilocytes occur when there is hepatic injury.
- Spherocytes occur in dogs only when there is an autoimmune hemolytic state.

It is helpful to consider RBC morphology in tandem with the presence of reticulocytes to ascertain the conditions for regeneration.

In general, a macrocytic/normochromic anemia suggests regeneration (high mean cell volume [MCV]/normal mean cell hemoglobin concentration [MCHC]); a microcytic/hypochromic anemia suggests iron deficiency (low MCV/low MCHC); and a normocytic/normochromic anemia suggests a lack of regeneration (normal MCV/normal MCHC).

Regenerative anemia is macrocytic/normochromic and characterized by variable RBC size, polychromasia, anisocytosis, nucleated RBCs, Howel Jolly Bodies (nuclear remnants on cell surface), and a reticulocyte count greater than 50,000 in cats and 60,000 in dogs. Hemolytic anemia is macrocytic/hypochromic and characterized by spherocytosis and reticulocytosis, if regenerative. Differentials include IMHA, hemoplasmosis, Heinz body anemia, DIC, pyruvate kinase deficiency (in the Basenji, West Highland, White Terrier, and Beagle), or phosphofructokinase deficiency (in the Springer Spaniel). Gastrointestinal bleeding occurs in cases of microcytic/hypochromic anemia with variable reticulocytosis and iron deficiency. Anemia of chronic disease is typically characterized by normocytic/normochromic anemia and subnormal reticulocytes.

Regenerative Anemia: Regenerative anemia indicates blood loss or the destruction of RBCs and is the result of a particular cause that must be ascertained. Initially, one should evaluate for overt blood loss at an intracavitary level, either in the abdomen or thorax; ascites or pleural effusion can be detected radiographically or ultrasonographically. Centesis would confirm the presence of whole blood. Pericardial effusion can also occur secondary to anticoagulant toxicity as right atrial masses do not

typically manifest in cats. Splenic contraction transpires in the face of acute anemia; a small spleen may be noted sonographically. If there is no evidence of trauma or intracavitary blood loss, then one must evaluate for GI blood loss. Regenerative anemia in cases of subnormal albumin levels suggests a GI hemorrhage. An occult blood test can be done on the feces; however, one must remember that a false positive can result from myoglobin in ingested meat. Thus, this test can be difficult to interpret in carnivorous feline patients. Melena may be noted in the feces if GI ulceration is present. An ultrasound exam can be done to evaluate for the presence of GI bowel lesions or masses that result in significant blood loss.

Once blood loss has been excluded as a possible cause, one should consider hemolysis as the other main differential diagnosis for regenerative anemia. Hemolysis is characterized by marked anemia without hypoproteinemia or other evidence of blood loss. Primary IMHA is an autoimmune disorder; it is not as common in cats as in dogs, and the diagnosis is based on ruling out other conditions. Secondary IMHA occurs secondary to infectious or neoplastic conditions, or may be the result of a drug reaction that triggers an immune response. Thoracic radiographs and abdominal ultrasound are indicated to evaluate for neoplasia. Practitioners should also rule out FeLV and *M. felis* (previously known as *Hemobartonella felis*)—both possible inciting causes of hemolytic anemia—as well as a history of drug exposure. An IFA or PCR for *M. felis* is available. A slide agglutination test and a Coomb's test should be performed to determine the presence of auto-agglutination and anti-RBC antibodies. Spherocytosis is more difficult to identify in cats because of its normally round erythrocyte morphology. *Cytauxzoon felis* is diagnosed by visualizing organisms on a blood smear (note: confusion with *M. felis* can occur) and/or PCR. It is often accompanied by mild anemia, thrombocytopenia, and leukopenia, and is more common in the southeast and south central USA as well as Brazil, southern Europe, and Africa.

Non-Regenerative Anemia: Causes of non-regenerative anemia include: chronic iron deficiency; chronic inflammatory disease/anemia of chronic disease; infection (primarily FIV or FeLV); chronic renal failure; neoplasia; and bone marrow dyscrasias or neoplasia. Note: Abyssinian and Somali cats may have a hereditary condition in which their erythrocyte membranes are more fragile, which can lead to anemia; it can be diagnosed with an osmotic fragility test. It is important to note that some cases of hemolytic anemia may involve an immune response to erythrocyte precursors at the level of the bone marrow, which can cause a non-regenerative anemia. As cats have a poor reservoir of RBCs in their spleens, 50% or more of cats with IMHA may display non-regenerative anemia.

In dogs, non-regenerative anemia can occur because of certain infectious disease (e.g. Parvo, *Ehrlichia Anaplasma*), endocrinopathies, drugs (e.g. sulphonamides, chloramphenicol, fenbendazole, albendazole, various cancer chemotherapeutics, and griseofulvin), radiation therapy, immune-mediated bone marrow disease, and myelopthisis.

Treatment: Successful treatment of feline anemia depends on how well the underlying cause (i.e., GI ulcerations, renal failure, or blood loss secondary to coagulopathy) is managed. Therapy for IMHA in cats and dogs involves the use of immunosuppressive medications, such as prednisolone or prednisone. The dose is 1-2 mg/kg/day and should be weaned until it is being administered daily or every other day. Cyclosporine can be added at 5 mg/kg PO BID. Azathioprine is not used in cats as it can cause severe

bone marrow suppression. Prednisone (2 mg/kg PO Q12-24hr) and azathioprine (2 mg/kg PO Q24hr) are indicated in canine IMHA. Low-dose aspirin (0.5 mg/kg/day PO) should be considered for dogs in light of the hypercoagulable state that occurs in IMHA cases.

Management of an infectious disease is dependent upon the etiology. In cats, for example, *M. felis* is treated with doxycycline (10 mg/kg PO Q24hr), enrofloxacin (5 mg/kg PO Q24hr), or marbofloxacin (2.75 mg/kg PO Q24hr). The duration of treatment is 2-4 weeks. Prednisolone is often used concurrently to treat the immune-mediated component of this disease (1-2 mg/kg/day). *Bartonella* is treated with oral doxycycline at 10 mg/kg/day for 7 days as a therapeutic trial; however, long-term therapy (up to 6 weeks) and follow-up are both key to effective treatment. Enrofloxacin (5 mg/kg/day PO Q24hr) is a good alternative in cats that do not respond well or exhibit adverse effects to doxycycline. Azithromycin (10 mg/kg/day for 21 days) has resulted in rapid responses and may therefore be efficacious, but *B. henselae* has demonstrated resistance to this medication. *Cytauxzoon felis* is often fatal, but treatment with imidocarb diproprionate (5 mg/kg mg IM) is often successful if the disease is diagnosed early on. *Babesia* can be treated with either imidocarb diproprionate (6.6 mg/kg IM) or diminazene aceturate (3-5 mg/kg IM), and *Ehrlichia* and *Anaplasma* spp. with doxycycline (10 mg/kg PO Q24hr for 28 days).

Conclusion: When faced with anemia, it is very important to determine the regenerative response. Sheer reticulocyte numbers are only marginally helpful; one must determine whether the reticulocytes are punctate or aggregate since reticulocyte numbers can be rather large in healthy patients. Once the degree of bone marrow response has been ascertained, one can decide more accurately what further diagnostics to pursue and develop the most efficient and effective treatment plan accordingly.

References:

Abrams-Ogg ACG. Nonregenerative anemia. In: Ettinger SJ, Feldman EC, eds. *Textbook of Veterinary Internal Medicine, 7th ed*. Philadelphia, PA: WB Saunders; 2010:786-96.

Abrams-Ogg ACG, Wood DR, Cheung A. Idiopathic non-regenerative anemia in cats: a retrospective study. *J Vet Intern Med* 2007;21:624 (abstract).

Abrams-Ogg ACG. Regenerative anemia in cats. Proceedings from the 64th Convention of the Canadian Veterinary Medical Association, Montreal, QC, July 11-14, 2012.

Balch A, Mackin A. Canine immune-mediated hemolytic anemia: treatment and prognosis. *Comp Cont Educ Practicing Vet* 2007;29:230-38.

Birkenheuer AJ, Le JA, Valenzisi AM, Tucker MD, Levy MG, Breitschwerdt EB. Cytauxzoon felis infection in cats in the mid-Atlantic states: 34 cases (1998-2004). *J Am Vet Med Assoc* 2006;228:568-71.

Cowgill ES, Neel JA, Grindem CB. Clinical application of reticulocyte counts in dogs and cats. *Vet Clin North Am Small Anim Pract* 2003;33:1233.

Shelton GH, Linenberger ML. Hematologic abnormalities associated with retroviral infections in the cat. *Semin Vet Med Surg (Small Anim)* 1995;10:220-33.

Spach DH, Koehler JE. Bartonella-associated infections. *Infect Dis Clin North Am* 1998;12:137-55.

Weiss DJ. Evaluation of dysmyelopoiesis in cats: 34 cases (1996-2005). *J Am Vet Med Assoc* 2006;228:893-97.