

## What's Your Diagnosis?

*Ellen Heinrich, Class of 2016*

**Signalment:** 11 month old, male intact Shi tzu dog

**History:** The patient presented to referring veterinarian on 6/5/15. The patient had a 2 day history of weakness and fatigue and had anorexia 1 day duration. The patient had vomited several times the evening before. The vomitus was characterized as a large amount of green watery fluid. The referring veterinarian ran bloodwork. CBC showed leukocytosis (20.02) and neutrophilia (17.23). Blood chemistry showed severe azotemia (Urea Nitrogen > 180, Creatinine 13.3), elevated total bilirubin (3.3), hypercalcemia (12.9), hyperphosphatemia (17.1), and hyperkalemia (5.9). Urinalysis showed urine specific gravity of 1.015, with urine dipstick showing trace glucose, ++ bilirubin, 7.0 pH, +30 protein (mg/dL), +1 RBCs, +2 epithelial cells on urine sediment. The referring veterinarian treated the patient with famotidine (3mg IV), Cerenia (6mg) and LRS IV (10ml total). The patient was up to date on all vaccines except had never received a leptospirosis vaccine.

**Presenting Complaint:** Presented to KSU VHC for acute renal failure as diagnosed by referring veterinarian.

**Physical Exam:** On presentation the patient was quiet and depressed. Temperature 98.9, Pulse: 96, Respiration Rate: 30. Weight 5.8 kg. Mucus membranes were pink & moist. Capillary Refill Time: 2.5. Estimated 8% dehydrated. Other abnormalities noted included: inflamed right ear, and enlarged right submandibular lymph node. There were papules and crusts with erythema noted on ventral abdomen. An abnormal cardiac rhythm was noted on auscultation.

### **Diagnostic Plan:**

Patient was admitted to ICU and placed on IV LRS fluids and IV ampicillin (22mg/kg TID). Ultrasound was performed to further assess damage to kidneys and potentially liver. Blood chemistries, CBCs, and renal panels were evaluated regularly to monitor patient's renal function. Thoracic radiographs were taken when the patient developed respiratory distress to further assess potential etiologies.

### **Complete Blood Count and Blood Chemistry Abnormalities:**

At presentation and on multiple CBC & blood chemistries taken throughout 4 day stay in ICU:

- Severely azotemic (elevated Urea Nitrogen & Creatinine) at presentation and throughout 4 days staying in ICU
- Hyperphosphatemic
- Hyperkalemic
- Hypochloremic

On 3<sup>rd</sup> day in ICU patient also had following abnormalities on bloodwork:

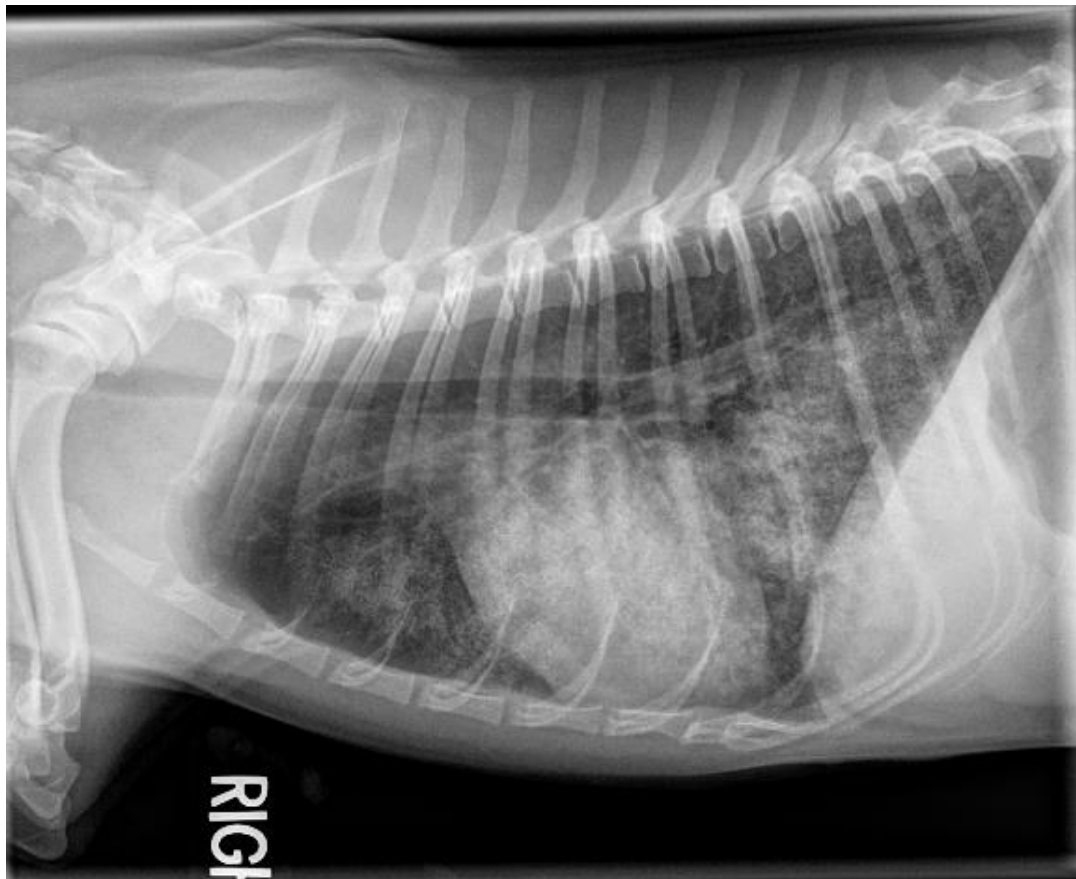
- Hypoalbuminemia 2.7 g/dL (ref 3.2)
- Hyperglobulinemia 3.6 g/dL
- Hypocalcemia 9.2 mg/dL
- elevated ALT 246 U/L (ref 144)
- elevated ALP 764 U/L (ref 130)
- elevated creatinine kinase 539 U/L (ref 210)
- elevated bilirubin 2.7 mg/dL (ref 0.2)

**Additional Testing:**

- Urine culture on 6/5/15 positive for hemolytic *Staphylococcus* species
- Leptospirosis PCR with DNA extraction of urine on 6/5/15 was positive for 2 serovars of leptospirosis: Grippotyph (1:100) and Icterohaemo (1:200)

**Thoracic Radiographs:**

**Right Lateral**



Left Lateral



## Ventral-dorsal View



### **Radiographic Interpretation:**

There is generalized, asymmetric, poorly defined increase in soft tissue opacity throughout the pulmonary fields that is patchy to coalescing in the ventral lung fields. The increase in soft tissue opacity is most pronounced in the caudal segment of left cranial lung lobe and the left caudal lung lobe. In the cranial lung lobes there is a mottled increased soft tissue opacity. Tram lines and small ring shadows are seen throughout all lung lobes. The cardiac silhouette has complete border effacement with the surrounding lung fields on the left side and incomplete border effacement ventrally. There is slight retraction of the lung lobes from the dorsal and caudal thoracic margins by gas. The pulmonary vasculature is unremarkable.

The pulmonary pattern is consistent with bronchial pattern throughout and alveolar pattern in the caudal segment of left cranial lung lobe and the left caudal lung lobe.

**Radiographic Conclusion:**

Differentials for the bronchial pattern include: mineralization of the bronchi due to chronic inflammation, inflammation from an infectious disease process in the lungs, or fluid and cells in the peribronchial area of the lungs.

Differentials for ventral alveolar pattern include: thromboembolism, pneumonia, or atelectasis.

**Abdominal Ultrasound:**

**Left Kidney**



**Ultrasound Interpretation:**

Both kidneys were diffusely hyperechoic. Surrounding both kidneys there was a moderate volume of anechoic fluid that continued throughout the dorsal retroperitoneal space bilaterally. The prostate was partially visible and symmetrically enlarged. The urinary bladder contained a large amount of anechoic fluid.

The liver, spleen, left and right adrenal glands, and gastrointestinal tract were unremarkable. Prostate size was consistent with male intact status.

## **Ultrasound Conclusion:**

The appearance of the kidneys and surrounding retroperitoneal space on ultrasound is consistent with bilateral nephritis.

**Final Outcome:** Patient went into cardiopulmonary arrest (CPA) on 6/8/15, was intubated and chest compressions were started then placed on continued mechanical ventilation per owner's wishes. Patient continued to decline with poor oxygen stats and hypotension despite therapy. Massive amount of pulmonary edema came from patient's endotracheal tube and CPA occurred again, CPR initiated for 20 minutes and patient was defibrillated about 10-20 times. At 20 minutes into therapy, the owner elected to stop lifesaving measures and the patient was euthanized.

Patient was presented for necropsy with specimens taken for histopathology.

## **Necropsy Results:**

### Gross Pathology:

- **Lungs:** diffusely dark red, edematous and rubbery.
  - The mucosa of trachea was diffusely gritty and rough.
- No other significant gross lesions in other organs.

### Histopathology Description:

- **Kidneys:** Multifocally, the tubular epithelial cells are hypereosinophilic. The nuclei of these cells are pyknotic, swollen, and detached from the basement membrane. The tubules contain sloughed epithelial cells and mineralized structures. The cortical interstitium contains many foci of inflammatory cells including lymphocytes, plasma cells, and a few macrophages which congregate around remnants of tubules. No inflammation or edema was noted surrounding the kidneys.
- **Lungs:** The alveolar septa and bronchiolar submucosa are severely mineralized. The alveoli contains small amounts of fibrin and red blood cells with a few macrophages. The bronchial and bronchiolar lumens contain fibrin and mucoid material that contains degenerative neutrophils. The submucosa of the airways is expanded in multiple areas with edema that contains neutrophils.
- No other significant microscopic lesions in other organs.

**Necropsy Conclusions:** The microscopic renal lesions are consistent with *Leptospira* sp. infection which correlates with the positive PCR for *Leptospira* sp. in the urine of the patient. The mineralization in the lungs, trachea, and blood vessels is from metastatic calcification secondary to renal failure. The calcium: phosphate product in the dog from clinical pathology report dated 6/8/15 was 108.56 (Calcium 9.2 x Phosphorus 11.8 = 108. 56); soft tissue mineralization can be seen with a product over 60-80.

## **Discussion: Radiograph and ultrasound changes to support Leptospirosis diagnosis**

Leptospirosis is a zoonotic disease caused by spirochete bacteria. *Leptospira* sp. multiplies within renal tubule epithelial cells and causes acute nephritis. *Leptospira* sp. also can affect the liver, causing centrilobular necrosis, bile canaliculi, and occlusion of the bile ducts that can lead to icterus. Leptospirosis can be challenging to diagnose due to non-specific clinical signs associated with the disease such as lethargy, anorexia, and vomiting. Dogs with leptospirosis may also exhibit coughing and labored breathing.

Imaging modalities such as ultrasound and radiographs may help support clinical suspicion of leptospirosis. Abdominal ultrasound is commonly performed in animals where leptospirosis is a differential to further evaluate the liver and kidneys. A retrospective study<sup>1</sup> of 20 dogs documented the following ultrasound findings in dogs with a confirmatory diagnosis of leptospirosis: increased renal cortical echogenicity (n=15), renalmegaly (n=10), pyeloectasia (n=9), medullary band of increased echogenicity (n=6), and perinephric effusion (n=5). Three of the dogs in this study did not show any abnormalities on ultrasound. In the present case report, the patient had increased renal cortical echogenicity, renalmegaly, and perinephric effusion which are consistent with acute nephritis and increase the suspicion of leptospirosis when taken in context of the whole clinical picture.

Thoracic radiographs may be taken in patients with respiratory signs and high suspicion of leptospirosis. Interstitial pneumonia has been documented in people with leptospirosis.<sup>2</sup> In one study of 4 dogs diagnosed with leptospirosis<sup>3</sup>, however, the radiographic changes were described as reticulonodular pulmonary opacities affecting the entire lung in 3 of the 4 dogs and predominantly the caudodorsal lung field in 2 dogs. This paper<sup>3</sup> describes this radiographic lung pattern as most likely associated with pulmonary hemorrhage due to endothelial damage and vasculitis. The patient in this case report developed signs of labored breathing and respiratory distress while being hospitalized so thoracic radiographs were taken. In this patient, radiographic changes were more consistent with a bronchial pulmonary pattern that was most severe in the ventral lung fields. Bronchial lung patterns are created by increased thickening of the bronchial walls or increased cellular or fluid infiltration or peribronchial cellular infiltration.<sup>4</sup> Bronchial patterns are recognized by an increase in conspicuity of bronchi and bronchioles in the lung fields seen as an increased number of ring shadows and tram lines of the gas-filled bronchi and bronchioles surrounded by increased soft tissue opacity on their lumens.<sup>4</sup> This bronchial pattern correlated well with necropsy findings of pulmonary edema and mineralization of the trachea, bronchi, bronchioles and alveoli.

The patient in this case report developed leptospirosis which affected its hepatic function, leading to icterus, and its renal function, leading to acute nephritis and subsequent acute renal failure which was diagnosed by bloodwork and ultrasound findings. The renal failure led to systemic mineralization, including mineralization of the epithelium of the respiratory tract, seen as an interstitial pattern on radiographs.

## References:

1. Baumann D, Fluckiger M: Radiographic findings in the thorax of dogs with leptospiral infection. *Vet Radiol Ultrasound*. 42:305-307 2001 PMID: 11499704
2. Forrest LJ, et al.: Sonographic renal findings in 20 dogs with leptospirosis. *Vet Radiol Ultrasound*. 39 (4):337-340 1998 PMID: 9710138
3. Andreescu N, et al. Leptospirotic etiology in pulmonary and upper respiratory tract pathology. *Roum Arch Microbiol Immunol*. 1999 Jul-Dec;58(3-4):273-9. PMID: 11845465
4. Thrall, Donald E. *Textbook of Veterinary Diagnostic Radiology*. 6<sup>th</sup> ed, Raleigh, NC: North Carolina State University. 2013.