Live Webinar

A Review of Pulmonary Patterns

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Proper Radiographs

- **Which views?**
  - One lateral plus ventrodorsal (at least)
    - Left lateral is best for thorax
    - Three views for full metastatic check

Proper Radiographs

- **Right vs. Left Lateral Thorax**

Images from NCSU
Proper Radiographs

- Which views?
  - Pathology needs to be on the upside of the patient
  - Atelectasis will mask any lesions in the down lung
  - Applies for VD/DV and left vs. right laterals

Proper Radiographs

- Correct positioning according to pathology

Proper Radiographs

- DV vs. VD (pathology needs to be UP)
Proper Radiographs

- Right vs. Left (pathology on up side)

Exposure
- Want to assess fine details of lungs
- Higher kvp and lower mAs best
- On VD should be able to just make out spine through cardiac silhouette
- Adjust settings according to each patient
  - Fat, gas, fluid, alveolar disease

Accurate Interpretation

- Systematic approach
  - Pulmonary Patterns
  - Cardiovascular Structures
  - Mediastinum
  - Musculoskeletal Structures
Accurate Interpretation

- Normal vs. Abnormal
- Distribution
- Clinical signs
- Breed, age, sex
- Concurrent thoracic changes
- Does the entire picture fit?

Pulmonary Patterns

- Alveolar
- Bronchial
- Interstitial
  - Nodular or structured
  - Unstructured
- Combination patterns
- Mineralization within pulmonary parenchyma
- Vascular (not really pulmonary)

Alveolar Disease

- Alveoli full of fluid
  - Blood (contusions, coagulopathy)
  - Pus (aspiration pneumonia, hematogenous pneumonia)
  - Water (heart failure, vasculitis, noncardiogenic edema)
- Atelectic lung lobes
- Neoplasia (bronchogenic carcinoma and metastatic in cats)
Alveolar Disease

- Signs
  - Air bronchograms
  - Silhouetting sign
  - Lobar sign

Alveolar Disease

- Air Bronchograms

Alveolar Disease

- Silhouette Sign
Alveolar Disease

- **Lobar Sign**

- **Location, location, location**
  - Right middle lung lobe/Ventral (aspiration)
  - Ruminants Right Cranial Lung (tracheal bronchus)
    - Caudodorsal (noncardiogenic)
  - Right caudal lung lobe/perihilar? (cardiogenic edema)
  - Patchy distribution (hemorrhage)
  - Concurrent cardiac shift (atelectasis)

- **Pneumonia (Bacterial)**
Alveolar Disease

- Pneumonia (Bacterial)

Alveolar Disease

- Noncardiogenic Pulmonary Edema

Alveolar Disease

- Cardiogenic Edema
Alveolar Disease

- Cardiogenic Edema

Images from NCSU

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Alveolar Disease

- Edema?

Images from NCSU

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Alveolar Disease

- Cardiogenic Edema—DCM

Images from NCSU

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Alveolar Disease

• Bronchogenic Carcinoma/Metastatic Disease—Cats

Images from NCSU

Alveolar Disease

• Atelectasis—Cardiac Shift

Images from NCSU

Alveolar Disease

• Warfarin Toxicity

Images from NCSU
Alveolar Disease

- Warfarin Toxicity

Alveolar Disease

- Concurrent thoracic changes
  - Vessels, heart, esophagus, fractured ribs, trachea, larynx, etc.
- Breed/History
  - Murmur, coughing, vomiting, rodenticide toxicity, IMHA, HBC, head trauma, etc.

Bronchial Disease

- Signs
  - Doughnuts
  - Railroad tracks
  - Peribronchial cuffing
  - Digital imaging advancement
Bronchial Disease

- Most often diffuse, but can be lobar
- Often times combined with interstitial disease
- Severity, is there bronchiectasis present?
- Breeds
  - West Highland white terriers

Bronchial Disease

- Differentials
  - Chronic inflammation (bronchitis)
  - Parasitic (aelurostrongylosis)
  - Peribronchial cuffing:
    - Early edema
    - Bronchopneumonia
    - Pulmonary eosinophilic infiltrates (may have nodules)
Bronchiectasis

Bronchial Disease

- Pulmonary Eosinophilic Infiltrates

Bronchial Disease

- Other things to look for
  - Pulmonary hyperinflation or air trapping
  - Tenting of diaphragm from chronic increased respiratory effort
Bronchial Disease

Interstitial Disease

- **Structured/Nodular**
  - Signs
    - Solitary nodules present (mass or small nodules)
      - Cavitated
      - Non-cavitated
    - Single noncavitated
      - Small in size
        - Metastatic nodule
        - Granuloma
        - Abscess
      - Large in size
        - Primary pulmonary carcinoma (caudal lungs)
        - Granuloma
        - Abscess

- **Unstructured**
  - Signs
    - Hazy increased opacity to lungs *(does not cause silhouetting)*
Interstitial Disease

• Structured/Nodular
  – Single and Cavitated
    • Primary pulmonary carcinoma (large)
    • Metastatic disease (secretory tumors)
    • Abscess
    • Granuloma (parasitic disease)
    • Fluid-filled bulla
    • Cyst

• Structured/Nodular
  – Multiple small in size
    • Metastatic disease (can be cavitated)
    • Granulomas (fungal disease)
    • Abscesses
  – Multiple large in size or variable sizes
    • Primary pulmonary neoplasia
    • Malignant Histiocytosis
    • Fungal Disease
    • Lymphomatoid Granulomatosis
    • Metastatic disease

• Structured

Images from NCSU
Interstitial Disease
• Primary Pulmonary Carcinoma

Interstitial Disease
• Bullae

Interstitial Disease
• Unstructured
  - Distribution variable
  - Hazy appearance to lungs
    Remember freshman histology

http://nhscience.lonestar.edu/biol/respiratory/alveoli.htm
Interstitial Disease

- **Unstructured**
  - Things that may enhance interstitial pattern
    - Age of patient
    - Expiration
    - Sedation
    - Exposure
    - Anesthesia
    - Lateral vs. Ventrodorsal

Interstitial Disease

- **Expiratory vs. Inspiratory Radiographs**

Interstitial Disease

- **Unstructured**

Images from NCSU
Interstitial Disease

- Unstructured

Interstitial Disease

- Unstructured

Interstitial Disease Differentials

- Diffuse
  - Artifact (digital)
  - Old lungs
  - Lymphoma
  - Pneumonitis
    - Viral
    - Parasitic
    - Metabolic
    - Inhalant
    - Toxic
  - Disease in Transition
    - Early-edema
    - Bronchopneumonia
    - Hemorrhage

- Localized
  - Partial lung collapse
  - Hemorrhage (early)
  - PTE
  - Bronchial FB
  - Diseases in Transition
    - Edema
    - Bronchopneumonia
    - Hemorrhage
    - Pulmonary Parasites

Textbook of Veterinary Diagnostic Radiology, Donald E. Thrall, fourth edition
Combination Patterns

- **Alveolar plus Nodular Interstitial**
  - Fungal disease (small nodules)
  - Malignant Histiocytosis
  - Lymphomatoid Granulomatosis
  - Abscesses?

- **Bronchointerstitial**
  - Chronic allergic lung disease
  - Pulmonary Fibrosis

Combination Patterns

- **Malignant Histiocytosis**

Mineralization of Lungs

- **Typically dystrophic**
  - Age related changes/idiopathic
  - Pulmonary osseous metaplasia
  - Chronic allergic lung disease
  - Previous abscess
  - Previous parasitic disease
  - Thromboembolic disease
  - Cushing’s Syndrome
  - Hypothyroid dogs with vascular mineralization
  - Chronic uremia

- **Neoplasia**
  - Not commonly seen
Pulmonary Mineralization

- Pulmonary Osseous Metaplasia

Vascular Mineralization

Pulmonary Mineralization

- Aortic Bulb Mineralization
Recap

- Decide which pulmonary pattern is present
- Distribution
- Look at concurrent pathology (heart, vessels, esophagus, abdomen, etc.)
- Make your differentials
- Does this fit with the clinic picture?
- What further tests might be needed to prove or disprove findings?

Still Confused?

Send your radiographs to a radiologist.

Thank you for attending today’s webinar:

A Review of Pulmonary Patterns

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