Pulmonary Patterns

VMA 976
PULMONARY PATTERNS

Which pulmonary patterns are commonly described in veterinary medicine?
PULMONARY PATTERNS

- Normal
- Alveolar
- Interstitial
  - Structured/Nodular
  - Unstructured
- Bronchial
- “Mixed”
  - Bronchointerstitial
- Vascular
NORMAL PATTERN

• Can be the most difficult pattern to identify!

• Normal is NOT synonymous with UNSTRUCTURED INTERSTITIAL !!!!!!
  • Patient caseload at NCSU-CVM makes unstructured interstitial a common pattern but it is NOT normal

• Normal means that there is no radiographic evidence of pulmonary pathology
Normal lateral thorax

- Can see intrathoracic structures
- Margins of vessels (and other structures) are well defined
ALVEOLAR PATTERN

Radiographic Signs

What are 4 radiographic signs of an alveolar pattern?
ALVEOLAR PATTERN

**Radiographic signs**

- Increased soft tissue opacity
  - Fairly non-specific, can be seen with other patterns
- "Air Bronchograms"
  - **WHAT IS AN AIR BRONCHOGRAM?**
  - Does NOT have to be present to have an alveolar pattern
  - Cannot see the walls of the bronchi
- Cannot see pulmonary vessels
- "Special circumstances"
  - May have a summation effect over the heart
  - May have a lobar sign if at periphery of lung lobe
Alveolar Pattern

Summation effect over the heart

Air bronchogram

Can't see vessels or bronchial walls in affected area
Is Image 1 normal or abnormal? If abnormal which lobe(s) has an alveolar pattern? If abnormal give radiographic findings for the alveolar pattern.

Is Image 2 normal or abnormal? If abnormal, which lobe(s) has an alveolar pattern? If abnormal give radiographic findings for the alveolar pattern.
Image 1
ABNORMAL!
Cranial lung lobe
- probably LEFT

Increased soft tissue opacity
Vessels obscured

Small air bronchograms
ABNORMAL!
Right middle lung lobe

**ALWAYS** remember to check the esophagus if you suspect aspiration pneumonia!

**ALWAYS** check for aspiration pneumonia if you suspect megaesophagus!

- Dilated esophagus
- Summation effect over heart
- Ventral deviation of trachea
- Increased soft tissue opacity
- Air bronchograms
- Lobar sign
An alveolar pattern can be the result of 2 different pathophysiologica mechanisms.

Identify the 2 causes of an alveolar pattern.

What are the terms used to describe the 2 different causes of a alveolar pattern?
ALVEOLAR PATTERN

- Atelectasis vs. Consolidation
  - Atelectasis
    - Loss of air in alveoli
  - Consolidation
    - Fluid or cells in alveoli

- Why important?
  - Treatment based upon cause of alveolar pattern
    - Treatment for collapsed lung lobe different from pulmonary edema
ALVEOLAR PATTERN

What are the radiographic signs of atelectasis vs consolidation?
ALVEOLAR PATTERN

PATHOPHYSIOLOGY

* Atelectasis vs. Consolidation

- **Atelectasis**
  - Mediastinal shift
  - Decreased size of lung lobe
  - Often associated with pleural disease
    - Pneumothorax
    - Pleural effusion

- **Consolidation**
  - No mediastinal shift
  - Lung lobe normal size
  - May or may not have pleural disease
Atelectasis

Small (collapsed)
Lung lobe w/alveolar pattern

“Free air” in the pleural space (pneumothorax)

Mediastinal shift - heart shifted to left hemithorax
Consolidation

Alveolar pattern right cranial and middle lung lobes. No mediastinal shift.
ALVEOLAR PATTERN

List differentials for an alveolar pattern

Include any specific distributions of the pattern that may influence making that differential designation
ALVEOLAR PATTERN

✿ Differentials
   ✿ Pneumonia
      ✿ Bronchopneumonia
      ✿ Aspiration
      - Often ventral
      right middle lung
      lobe affected?
   ✿ WHY is this lobe commonly affected?
   ✿ Hemorrhage
   ✿ Edema
      ✿ Cardiogenic
         - "Perihilar"
      ✿ Non-cardiogenic
         - "Caudodorsal"
   ✿ Neoplasia
   ✿ Atelectasis
STRUCTURED INTERSTITIAL PATTERN

What are the 2 main categories for a structured interstitial pattern?
STRUCTURED INTERSTITIAL (NODULAR) PATTERN

Cavitary or Non-cavitary

Cavitary
- Contains a gas opacity
- Gas
- Gas + soft tissue
- Gas + mineral
- Gas + soft tissue + mineral

Non-cavitary
- NO gas opacity
- Soft tissue
- Mineral
- Soft tissue + mineral
- Fat is UNCOMMON
Structured Interstitial Pattern

Non-cavitary structured interstitial pattern

Cavitary structured interstitial pattern

Gas in pulmonary mass
Structured Interstitial Pulmonary Osteomas
How do you tell an end on vessel from a pulmonary nodule?

List 6 ways to identify an end on vessel
STRUCTURED INTERSTITIAL PATTERN

- End on vessel vs a nodule
  - Vessel
    - Smooth margins
    - Associated with other vessels
    - Same size or smaller than associated longitudinal vessel
    - More “opaque” than expected for size
      - Due to summation effect
    - Follows a “pattern”
    - May be associated with a bronchus
End-on vessels vs. pulmonary nodules

Note that:
1. End-on vessels are associated with longitudinal vessels
2. End-on vessels are no larger than longitudinal vessels
3. End-on vessels have smooth margins and have a “strong soft tissue opacity
STRUCTURED INTERSTITIAL PATTERN

List differentials for a non-cavitary structured interstitial pattern
  - Soft tissue
  - Mineral

List differentials for a cavitary structured interstitial pattern
STRUCTURED INTERSTITIAL PATTERN

**Soft Tissue**
- Neoplasia
  - Primary
  - Metastatic
- Fungal
- Parasitic
- Inflammatory
  - Eosinophillic
- Abscess
- Cyst

**Mineral**
- “Osteoma”
- Fungal
- Neoplasia
  - Cat

**Cavitary**
- Neoplasia
  - Primary
- Bulla
- Abscess
- Parasitic
UNSTRUCTURED INTERSTITIAL PATTERN

What technical factors can influence the determination of the presence of an unstructured interstitial pattern?
UNSTRUCTURED INTERSTITIAL PATTERN

Technical Factors

- Phase of respiration
  - Expiratory
    - Heart & diaphragm are in close contact

- Fat animal
- Motion
- Underexposure
Same dog, same lateral. One film on inspiration, the other on expiration.

Note increased soft tissue opacity of lungs. Also note smaller size of lung lobes and close position of heart and diaphragm on expiratory view.
UNSTRUCTURED INTERSTITIAL PATTERN

Radiographic signs

What are 4 radiographic signs of an unstructured interstitial pattern?
UNSTRUCTURED INTERSTITIAL PATTERN

Radiographic signs

- Increased soft tissue opacity
- Fuzzy, hazy, lacy appearance
- Can still see vessels
- Peribronchial enhancement
  - Margins of bronchi are easier to see because of increased soft tissue opacity between bronchus and alveoli

Similar to looking through a screen

- Can see all structures but a fine pattern between you and the outside
What is the pathophysiology behind an unstructured interstitial pattern?

- “Active”
- “Old dog”
UNSTRUCTURED INTERSTITIAL PATTERN

Pathophysiology

- Fluid, cells or fibrosis in the interstitial space
- “Active” vs “Old dog”

Active
- Fluid or cells in the interstitial space
  - Tends to look more “fuzzy”

Old dog
- Fibrosis in the interstitial space
  - Tends to look more linear
Unstructured interstitial
"Active"
BRONCHIAL PATTERN

Radiographic Signs

Name 4 radiographic signs of a bronchial pattern
BRONCHIAL PATTERN

**Radiographic Signs**

- Increase in size of bronchi
  - Can see in periphery of lung field

- **Apparent** increase in number of bronchi
  - Due to increase in size, can see more bronchi
  - Look in periphery of lung field

- Loss of taper (parallel bronchial walls)
  - “Tram lines”, “Train tracks”

- Bronchial wall mineralization
  - May be an aging change
Large cranial lobar bronchus with a loss of taper. Also bronchial wall mineralization.