Pathology of the Respiratory System 4:
Lung – Pneumonia

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DISORDERS OF THE LUNG

- Congenital
- Pigmentary deposition
- Circulatory Disturbances
- Inflation disturbances
- Pneumonia
- Neoplasia
LUNG – PNEUMONIA

NORMAL

Suppurative Bronchopneumonia
Craniocentral and firm

Fibrinous Bronchopneumonia
Craniocentral and hard

Interstitial Pneumonia
Diffuse and Elastic

Embolic Pneumonia
Multifocal and nodular

Granulomatous Pneumonia
Multifocal and nodular
LUNG – PNEUMONIA

NORMAL

Suppurative Bronchopneumonia
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Fibrinous Bronchopneumonia
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Examples of Diseases that Cause Bronchopneumonia in Domestic Animals

- Suppurative Bronchopneumonia
- Fibrinous Bronchopneumonia
Multifactorial Etiology:

- Environmental factors*
  - Crowding, humidity, temperature, air quality, stress
- Viral infection*:
  - BRSV
  - BPIV-3
  - BoHV-1 (IBR)
- Bacterial infection
  - *Pasteurella multocida*
  - *Histophilus somni*
  - *Mycoplasma bovis*
  - *Trueperella pyogenes*
  - *Mannheimia hemolytica*

High morbidity / Low mortality
Enzootic Pneumonia of Calves

- Suppurative bronchopneumonia
- Should do bacteriologic culture and virologic testing!
Shipping Fever (Pneumonic Mannheimiosis)

- Part of the normal URT flora
- Impairment of pulmonary defence mechanisms:
  - Environmental factors / stress
  - Transit, crowding
- Viral infections: (BRSV, BPIV-3, BoHV-1)

Etiology: *Mannheimia hemolytica*

Fibrinous bronchopneumonia

Bacteria produce leukotoxins → sepsis and death

Low morbidity / High mortality
Shipping Fever (Pneumonic Mannheimiosis)

LUNG – BRONCHOPNEUMONIA - CATTLE

Coagulative necrosis
LUNG – BRONCHOPNEUMONIA - CATTLE

Shipping Fever (Pneumonic Mannheimiosis)

Other bacteria causing similar lesions:
- *Histophilus somni*
- *Mycoplasma mycoides* ssp. *mycoides* small colony type
  - Contagious bovine pleuropneumonia – exotic / reportable disease
  - Often affects the caudal lobes and sequestra are common
Etiology: *Mycoplasma bovis*

- Necrosuppurative bronchopneumonia and bronchiectasis (=dilation and destruction of bronchioles)

Gross images:

- Lung abscesses

- Difficult to differentiate grossly from abscesses
LUNG – BRONCHOPNEUMONIA - CATTLE

Etiology: Mycoplasma bovis

Doesn’t grow on routine culture:
- Mycoplasma specific culture,
  Histology + IHC, PCR

Gross images: Dr E Aburto
Ovine Enzootic Pneumonia

Multifactorial Etiology:

• Environmental factors
  • Crowding, humidity, temperature, air quality, stress

• Viral infection:
  • RSV
  • BPIV-3
  • Adenovirus

• Bacterial infection
  • Mannheimia hemolytica
  • Pasteurella multocida
  • Mycoplasma ovipneumonia
  • Histophilus somni

• Suppurative bronchopneumonia
• Should do bacteriologic culture and virologic testing!

High morbidity / Low mortality
Pneumonic Mannheimiosis

- **Etiology:**
  - *Mannheimia hemolytica*
  - Predisposing factors: Viral infection, Stress

- **Septicemic Pasteurellosis**
  - **Etiology:**
    - *Bibersteinia trehalosi*
    - Sepsis
    - Oral / esophageal ulcers

Fibrinous bronchopneumonia
Porcine Enzootic Pneumonia

- Often secondary to impairment of pulmonary defence mechanisms:
  - Environmental factors
  - Crowding ammonia, temperature, stress

Etiology: *Mycoplasma hyopneumonia*

High morbidity / Low mortality
Porcine Enzootic Pneumonia

Etiology: \textit{Mycoplasma hyopneumonia}

- Histology
- IHC
- PCR

\textit{P. multocida} is often isolated in suppurative bronchopneumonia of pigs
Porcine Pleuropneumonia

Etiology: *Actinobacillus pleuropneumonia* (APP)

- Highly contagious
  - 2-5 month old pigs
  - Sudden death with blood tinged froth from the nares
  - Dyspnea and coughing

High mortality in naïve herds
Porcine Pleuropneumonia

Etiology: *Actinobacillus pleuropneumonia* (APP)

Fibrinous bronchopneumonia
- Often dorsocaudal in distribution

- Coagulative necrosis
- Sepsis / Shock
- Sequestra

Images: Cornell Veterinary Medicine
• Most often secondary

• Common bacterial isolates:
  • *Pasteurella multocida*
  • *Streptococcus spp*
  • *Escherichia coli*
  • *Klebsiella pneumoniae*
  • *Bordetella bronchiseptica*
    • Cats
  • *Streptococcus equi zooepidemicus*
    • Fatal hemorrhagic pneumonia in dogs
Aspiration Pneumonia

AW YISS, crackers!

Meeb?

AH STOP TOO DRY TOO DRY!

HHHH!

Move it, epiglottis!

HHHH HHHH!

Man, Trachea, what a DAY!
Aspiration Pneumonia

- Secondary to vomiting
Aspiration Pneumonia

• Secondary to administering a “milk shake”
Aspiration Pneumonia

Cat

- Secondary to anesthesia
Examples of Diseases that Cause Interstitial Pneumonia in Domestic Animals

Rib Imprints and Elastic Texture
Etiology:

- Bovine parainfluenza virus 3
- Bovine respiratory syncytial virus
- Bovine herpesvirus 1
  - Disease name: Infectious Bovine Rhinotracheitis

Virologic testing:
- PCR
- FAT
- IHC
Atypical Interstitial Pneumonia

- Bovine Pulmonary Edema and Emphysema
- Extrinsic Allergic Alveolitis
- Reinfection Syndrome
- Inhalation of gases (H₂S or NO₂)
- BRSV
- Dictyocaulus viviparous
Atypical Interstitial Pneumonia - Bovine Pulmonary Edema and Emphysema (BPEE)

Pathogenesis

Tryptophan → 3-methyl indole (3-MI) in rumen

Tryptophan in blood to Club cells

LUNG – INTERSTITIAL PNEUMONIA - CATTLE
Atypical Interstitial Pneumonia - Bovine Pulmonary Edema and Emphysema (BPEE)

Edema and Emphysema

Interstitial pneumonia
LUNG – INTERSTITIAL PNEUMONIA - HORSES

**Equine influenza**
- Etiology: Equine influenza virus
  - Transient respiratory disease
  - High morbidity and low mortality

**Equine Viral Rhinopneumonitis**
- Etiology: Equine herpesvirus 4* and 1
  - Transient respiratory disease
  - Also neurologic disease and abortion (EHV-1)

Other viral diseases of the lung
- Equine herpesvirus 5
- Equine viral arteritis
- African horse sickness
- Hendra virus

**Virologic testing**
- PCR
- FAT
- IHC
Swine influenza
Etiology: Swine influenza virus

Porcine Reproductive and Respiratory Syndrome
Etiology: PRRS virus

PCV-2 Associated Respiratory Disease
Etiology: Porcine circovirus type 2 (PCV-2)

- High morbidity and low mortality
- Transient respiratory disease
- Predispose to bacterial pneumonia
LUNG – INTERSTITIAL PNEUMONIA - PIGS

Swine influenza, PPRS, PCV2AD

- Virologic testing
  - PCR
  - FAT
  - IHC
Other causes of interstitial pneumonia in pigs:

- Nipah virus
- Sepsis
  - *Salmonella* spp.
  - *Ascaris suum* migration
- Hypersensitivity
LUNG – INTERSTITIAL PNEUMONIA – DOGS AND CATS

Dogs
- Canine Distemper (Morbillivirus)
- Canine Parainfluenza
- Canine Adenovirus 2
- Canine Influenza

Cats
- Feline rhinotracheitis (FeHV-1)
- Feline Calicivirus
LUNG – INTERSTITIAL PNEUMONIA – SMALL RUMINANTS

Ovine Progressive Pneumonia (Visna-Maedi) (Lymphoid Interstitial Pneumonia)

- Affects sheep
- Gross Findings
  - Heavy pale lung
  - Elastic texture
  - Emaciation
- Histology:
  - Lymphocytes in interstitium and hyperplastic BALT

Etiology: Visna Maedi virus (Retrovirus)
Caprine Arthritis and Encephalitis (CAE)

- Affects goats
- Gross Findings
  - Heavy pale lung with elastic texture
  - Emaciation, +/- arthritis, encephalitis
- Histology:
  - Lymphocytes in interstitium, hyperplastic BALT, proteinaceous fluid in alveoli

Etiology: CAE virus (Retrovirus)
Examples of Diseases that Cause Granulomatous Pneumonia in Domestic Animals
Tuberculosis

Etiology: *Mycobacterium bovis*

*Mycobacterium tuberculosis*

- Important in many species:
  - Humans, ruminants, pig, horses
  - Wildlife reservoirs
  - Chronic wasting
  - Granulomas
LUNG – GRANULOMATOUS PNEUMONIA – ALL SPP

Tuberculosis ⭐

**Etiology:** *Mycobacterium bovis*

- *Mycobacterium tuberculosis*
  - Multisystemic lesions
  - Granulomatous lymphadenitis
  - Granulomatous pneumonia
  - Spread via aerosol
  - Granulomas with acid-fast bacilli

PCR / special culture to confirm diagnosis