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Evaluation of the Coughing Horse

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Outline
- Review some standard diagnostic tools
- Cases

Bronchoalveolar lavage
- Method for collection of airway secretions in peripheral airways & alveoli
- Use:
  - Inflammatory airway disease
  - Recurrent airway disease “heaves”
  - EIPH
- Normal values:
  - 50-70% macrophages
  - 30-50% lymphocytes
  - <5% PMN
  - <2% mast cells
  - < 0.1% eosinophils

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Transtracheal Wash

- Major use is to culture lung
- Fluid cytology not useful for assessing chronic respiratory disease
- Cytology:
  - Presence of bacteria or fungal agents
- Culture
- Use is primarily in evaluating suspect infectious respiratory disease.

Endoscopy

- Assessment of upper airway dysfunction
- Evaluation of mucus in upper airways
- "Mucus matters"
- Uses:
  - Suspect upper airway dysfunction
  - May need to evaluate them during exercise
  - Coughing horse to rule out pharyngeal/laryngeal dysfunction or dysphagia
  - GP and sinus evaluation

Thoracic Ultrasound

- Normal lung is very unexciting
- Air reflect ultrasound waves so cannot see beyond visceral pleura
Thoracic Ultrasound

- Useful with pleural effusion
- Superficial lung disease

Thoracic Radiographs

- Non-effusive diseases
- Pulmonary abscess
- IAD
- RAO (heaves)
- Interstitial pneumonia
- Bronchopneumonia
- Neoplasia*

Pleural effusion limits the value of thoracic radiographs and should be drained prior to radiography.
Gabriel

- 18 year old Warmblood gelding
- History non-productive cough for 2 weeks duration coupled with mild fevers and weight loss.
- Horse eating well except when febrile (~ 1x daily)
  - Intermittent fevers controlled by Flunixin
  - Treated with TMS-SMZ for 1 week no significant improvement
- No history of travel, no new horses, no changes in management
- Vaccinated November 2008

Gabriel Physical Exam

- QAR, hydrated
- RR-28, mild nostril flare, normal temperature and pulse
- Thoracic auscultation - NSF with and without a rebreathing bag.
- Small amount of mucus could be ausculted within trachea.
- Cough elicited during rebreathing exam
Plan

- CBC?
- TTW?
- BAL?
- Thoracic Radiographs?
- Thoracic Ultrasound?
- Lung Biopsy?
- Endoscopy?

CBC

- WBC - 15,590 (5100-13120)
- PMN - 14,290 (1940-7400)
- Lymphocytes - 880 (960-5740)
- Fibrinogen 900 mg/dl (N 100-400)
- PCV - 32% TS - 7.2 g/dl
- Blood gas - no significant findings.
**Adult Interstitial Pneumonia:**

**Clinical Signs**

- A restrictive pulmonary disease
- Lung ventilatory capacity impaired
  - Dyspnoea, prolonged inspiratory phase (rapid low volume breathing)
  - Cough & nasal discharge
  - Pyrexia
  - Weight loss
  - "Heave line" (d. dx. RAO but + ↑ WBCC, Fib)
  - Steady decline, probable death

**Adult Interstitial Pneumonia**

- Known aetiological categories
  - Infectious agents
    - EHV-5? Other - bacterial and fungal
    - Ingested chemicals (PA Crotalaria, Senecio spp)
  - Inhaled chemicals (smoke, silicosis)
  - Hypersensitivity pneumonitis (inhalation of organic antigens)
  - ALI/ARDS

- Aetiology frequently undetermined...
Adult Interstitial Pneumonia: Pathogenesis

- **4 phases**
  - Acute alveolitis - exudative (response to initial insult)
  - Proliferation of cellular (TII Pneumocytes) and connective tissue compartments
  - Irreversible interstitial fibrosis
  - Irreparable generalized pulmonary fibrosis

- **Insidious**

- **Alveolar structural derangements**
  - Loss of gas exchange units
  - Altered mechanical properties of the lung

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Gabriel: Further Diagnostics

- **Upper Airway Endoscopy and TTW**
  - Normal appearance, minimal tracheal exudate
  - α-Streptococcus spp., Aspergillus spp. cultured → presumed airway contaminants
  - Cells retrieved consistent with mild neutrophilic inflammation; no fungal elements/neoplastic cells

- **BAL**
  - Cytology: 52% macrophages, 40% lymphocytes, 8% PMN. Mucus present

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Lung Biopsy

- Marked interstitial expansion by well-organized mature collagen. Alveolar walls were infiltrated by variable numbers of mixed inflammatory cells consisting primarily of macrophages, neutrophils and lesser numbers of lymphocytes and plasma cells. There was hyperplasia of type II pneumocytes. Rarely, there were large cells with abundant eosinophilic cytoplasm and prominent oval amphophilic intranuclear viral inclusion body with margined chromatin

- Diagnosis: Interstitial fibrosis with pneumonitis type II hyperplasia and rare intranuclear inclusion bodies.

- Suggestive of Equine Multinodular Pulmonary Fibrosis caused by EHV-5.
**Equine Multinodular Pulmonary Fibrosis: A Newly Recognized Herpesvirus-Associated Fibrotic Lung Disease**

- 24 horses with EMPF
  - Average age 14.5 years
  - EHV-5 detected in 100% using genera-specific PCR technique
- 23 control horses
  - EHV-5 detected in 0% (PCR test run on those horses with evidence of γ - herpesvirus infection)
- Recent work Wang et al. (2007) suggests that up to 78% foals have evidence of EHV-5 infections (nasal swab or peripheral WBC)
- Lower #s with increasing age...


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EHV-5 PCR

- BAL- positive
- Lung Biopsy- negative

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Equine Multinodular Pulmonary Fibrosis (EMPF)

- Gross pathology, 2 manifestations
  - Coalescing nodules of fibrosis (majority of lung affected)
  - Multiple discreet nodules
    - Pale tan/white nodules, clear border
EMPF and EHV-5
- Lag between exposure and disease?
- Individual animal risk factors?
- Is there a link??
  - EHV-5 found only in those horses with EMPF
  - Mechanism of γ-herpesvirus’ role in causing extensive pulmonary fibrosis unknown
    - Suggested that via production of cytokine analogues Th2 response favoured and virus evades escape; fibrotic disease results
  - Mirroring human work, Epstein-Barr virus etc

Gabriel- Treatment
- Sent home on Dexamethasone and Valacyclovir (oral bioavailability is better than Acyclovir)
- Dexamethasone – 0.1 mg/kg SID switched to Prednisolone 1mg/kg PO SID
- Valacyclovir 20 mg/kg SID.
- Initial response poor continued to have intermittent fevers & signs of respiratory compromise.
- Valacyclovir increased 30 mg/kg and Prednisolone increased to 2 mg/kg SID
Gabriel- Recheck February 2009

- BAR
- TPR within normal limits. Respiratory rate and character within normal limits, no nostril flare.
- Weight down 65 lbs.
- Rebreathing exam- no significant abnormalities. Trachea clear.
- Recheck Thoracic films

BAL- EHV-5 positive

Gabriel Feb 2009 treatment plan

- Continue Valacyclovir – 15 mg/kg BID for 3 more weeks
- Continue prednisone begin tapering dose
Gabriel re-exam March 2010

- BAR
- TPR within normal limits
- Weight gain of 150 lb since last exam
- Thoracic films recheck

Gabriel February 2009 April 2010

Feb 2009 & April 2010
BAL- March 2010

- Still positive for EHV-5 DNA.
- Horse clinically better

Questions that remain

- Is anti-viral therapy really necessary?
- Is EHV-5 the causative agent of EMPF?

Kenny- 4 year old Saddlebred Gelding

- Owner's purchased as a 2 year old.
- Started in training 7 months ago. Coughing with exercise and "makes a noise".
- Noise is worse at higher speeds.
- Owner/trainer feels horse is exercise intolerant.
- Physical exam:
  - T-99.3, HR-44 RR- 24
  - Rebreathing exam- lungs auscult normally, tracheal mucus noted
  - Mild bilateral nasal discharge

Plan

- CBC
- TTW?
- BAL?
- Thoracic Radiographs?
- Thoracic Ultrasound?
- Lung Biopsy?
- Endoscopy?
Endoscopy
- Grade 4 left laryngeal hemiplegia
- Trachea: Grade 4 mucus in trachea with plant material (food) evident

Plan?

CBC
- Normal fibrinogen (300 mg/dL)
- WBC: 7,880
- PMN: 5,090
- HCT: 29
- Total protein: 8.0 g/dL
  - Albumin: 2.9 g/dL
  - Globulin: 5.1 g/dL
Endoscopic tracheal wash

- Moderate ciliated columnar respiratory epithelial cells. Low numbers macrophages, lymphocytes and rare mast cells. Moderate amounts of mucus. Small amounts of plant material. No inflammatory cells or atypical cells seen. Few bacteria - suspect contamination.

Tracheal wash culture

- Few Strep zooepidemicus
- Alpha hemolytic Strep
- Diagnosis - Left laryngeal hemiplegia
  - Dysphagia
  - Suspect Pulmonary abscess
- Plan - Discharge on antimicrobials. Recheck in 4-6 weeks
  - Once abscess/infection is resolved consider surgical repair/correction of hemiplegia.
Kenny 6 week recheck

- Pulmonary abscess significantly smaller
- Still evidence on endoscopy of feed material in trachea
- Grade 4 left laryngeal hemiplegia
- Plan: Standing ventriculocordectomy

* Additional history obtained. As a yearling Kenny developed pleuropneumonia after "cosmetic surgery". Treated for 2 months with antimicrobials, chest tubes and pleurocentesis. Turned out for 6 months after pleuropneumonia prior to sale.

Joey- 7 year old STB gelding trotter

- Poor performance on/off since for ~ 1 year
  - Trainer feels Joey is simply getting older
  - In December 2010 Joey developed a bilateral nasal discharge and inappetance 2 days after a race.
  - Trainer treated with SMZ for 10 days continued to jog
- Since then performance continues to be poor.
  - Occasional coughing
  - No history of bleeding
  - No history of making a noise when working
- Fed 4 flakes hay a day, grain ad lib.
- Turned out 1-2 hours a day. Stalled in a training barn
  - Owner comments barn has a musty, closed in feel.
  - Stalls are wet "good for feet."

Joey- Physical exam

- BAR-H
  - HR-32 RR-16 T-98.8F
  - Rebreathing exam- lungs auscult normally, mucus could be ausculted in trachea
  - Submandibular LN mildly enlarged compared to normal "reactive"
  - Lameness exam- no significant abnormalities
Plan

- CBC
- TTW?
- BAL?
- Thoracic Radiographs?
- Thoracic Ultrasound?
- Lung Biopsy?
- Endoscopy?
- Treadmill endoscopy?

CBC

- HCT - 31% Total protein 6.8
- Fibrinogen 200 mg/dl
- WBC - 6,220
- PMN - 4,660
- Lymphs - 1,500

Upper airway endoscopy

- Normal laryngeal, pharyngeal & epiglottic function
- Guttural pouches empty though follicular hyperplasia present and walls appear edematous.
- Pharynx: grade 3 out of 4 pharyngitis (lymphatic follicular hyperplasia)
  - Mucosa edematous
  - Follicular hyperplasia
  - Grade 2 out of 5 mucus in trachea

Grade 1 occasional drops
Grade 2 numerous drops with coalescence
Grade 3 streams on ventral aspect of trachea
Grade 4 large accumulation with pooling
Grade 5 flood of mucus filling ~ ¼ trachea
Plan

- TTW?
- BAL?
- Thoracic Radiographs?
- Thoracic Ultrasound?
- Treadmill endoscopy?

Findings:
A diffuse moderate bronchial pattern is present, most severe caudally.

Interpretation: Chronic bronchitis, likely due to inflammatory airway disease, recurrent airway obstruction or EIPH (given severity of caudodorsal changes).
**Joey- BAL**

- **Microscopic Description**
  - Two concentrated preparations were examined and were highly cellular. Besides small numbers of erythrocytes and small quantities of stringing mucus material, they consisted mostly of macrophages with fewer lymphocytes and low numbers of mast cells. A 500 cell differential count revealed 58% macrophages, 25% lymphocytes, 15% neutrophils, and 2% mast cells. The majority of macrophages were highly vacuolated and contained abundant globular green-black hemosiderin pigment and moderate numbers of phagocytized erythrocytes.
  - **Interpretation:** Pathologic hemorrhage and neutrophilic inflammation; supportive of the provisional diagnosis of *exercise induced pulmonary hemorrhage & inflammatory airway disease*.

**Joey- Treatment plan**

- Discharged on tapering dose of Dexamethasone PO starting at 0.05 mg/kg (bioavailability is 60%) so increase dose accordingly.
- **Environmental management**
  - Get this horse out of training barn!
  - Ammonia and molds are irritating and toxic to respiratory epithelium
  - Ideal 24/7 turn out
  - Feed on ground (postural drainage)
- Rest for 30-60 days (seldom achieve later)
- When returns to racing recommend racing on Lasix

**Inflammatory airway disease**

- Most common manifestation is poor performance
- Other signs may be absent or subtle
- Typically alert, healthy horse with no history of fever
- Occasionally will have nasal discharge (after work out)- usually white/foamy
- Coughing tends to be rare
- Prevalence varies between trainers
  - Housekeeping, barn design, dust, prevailing winds as well as management may all play a role
  - Movement of horses in/ out of training stable may play a role
Inflammatory airway disease - Diagnosis

- Endoscopy: ideal between 40 and 120 minutes after racing
  - Presence of excessive mucus or blood
  - Green/yellow mucus suggestive of infectious component.
- Negative association with performance with mucus Grade 2 or higher “mucus matters”
- Presence of blood: EIPH
  - (which came first?)
- CBC & Chem usually unremarkable. Abnormal findings suggestive of infectious component to IAD

Inflammatory airway disease - Treatment

- Broad spectrum antimicrobials for 7-10 days
- Steroid therapy: may be sole therapy if cause is thought to be environmental NOT infectious.
- Clenbuterol: initially marketed for bronchodilatory effects and mucokinetic effects but actually shown to have anti-inflammatory effects.
  - 0.8 micrograms/kg po BID
- Others??
  - Cromolyn sodium: mast cell stabilizer
  - 200 mg nebulized
  - Acetylcysteine (mucomist) via nebulizer (20-50 mls of 10% solution)
  - Throat spray

IAD - Environmental management

- Synergistic interactions of infectious & environmental causes
- Reduce particle load in lungs
  - Ideal 24/7 outdoors
  - If cannot achieve make sure horse is outdoors when
    - Barn raked
    - Stalls cleaned
    - Hay thrown
    - Remove cobwebs
    - Power wash stable periodically
    - Minimize environmental dust
    - Wet hay?
    - Hay Steamer?
- Vaccination?
IAD- Summary

IAD is likely due to combination of infectious agents (viral and bacterial) coupled with environmental causes (dust, allergens) as well as immune status and work load/stress.

Doc- 10 year Belgian

- 1 month history of PU/PD
- Pulled at Great Lakes Draft Horse Festival in mid October
- Returned home
  - Febrile episode
    - Treated with Gentamycin & Flunixin
    - Fever returned- treated with Ceftiofur & Banamine
- Increased water intake & loose manure
- R'DVM pulled blood- normal CBC elevated BUN & Creatinine
  - R'DVM treated with Baytril & 5 liters of IV fluids & oral fluids daily
  - Continued to have fevers despite treatment- referred for further evaluation.

Doc- PE

- T- 101.4 HR- 42 RR- 24
- Rebreathing exam- lung sounds present but decreased in intensity in ventral lung fields. Cough elicited during rebreathing exam.
- Edema between front legs
- Jugular distension bilaterally
- PCV- 29 T.S.- 8.6
Plan?
- CBC?
- Urinalysis?
- Thoracic Ultrasound
- Thoracic Radiographs
- Endoscopy?
- TTW?
- BAL?

CBC
- HCT - 24.9
- Total Protein - 8.8 g/dl
- Fibrinogen - 1.0 g/dl
- WBC - 9,060
- PMN - 7,070
- Lymphs - 1,720

Urinalysis
- Specific gravity - 1.004
- No abnormalities seen

Chemistry
- Creatinine - 1.2
- BUN - 20
- Total Protein - 8.5
- Albumin - 2.3
- Globulin - 6.2
Thoracic Ultrasound

Transthracheal wash

Culture results Numerous gram + rods

Arcanobacterium pyogenes

Formerly Actinomyces pyogenes

Sensitive to beta lactams, cephalosporins, tetracyclines, macrolides

Moderate resistance to aminoglycosides, quinolones
Pleuropneumonia- Treatment

- Broad spectrum antimicrobials
- Drain effusion
- Supportive care
- Prognosis guarded - worse if delayed diagnosis and treatment.

Rib Resection
Pleuropneumonia

- Most commonly associated with long distance transport, strenuous exercise.
- As fluid accumulates lung sounds become quieter ventrally (normally louder ventrally).
- Fever will persist despite "appropriate" antimicrobials if effusion persists.
- Must identify and drain pleural effusion.

Sepsis?

- Compare blood glucose, lactate and pH to pleural fluid
- Glucose difference of > 50 mmol consistent with sepsis
- Lactate usually significantly higher in septic pleural effusion (pH lower).

Pleuropneumonia - Diagnosis

- Thoracic ultrasound*
- History of non-responsive fevers with ventral edema- think chest!!!
- History of shipping or strenuous exercise
- Usually abnormal CBC
- Transtracheal wash usually better culture specimen than pleural effusion but if possible culture both.

- Bottom line: Persistent fevers- Look in body cavities!
  - Abdominal compartment
  - Thoracic
  - Guttural pouch
  - Bladder/renal

QUESTIONS?