Cornell
Animal Health Diagnostic Center

Breathing Room:
Diagnosing and Sampling the Geriatric Asthmatic Horse

Toby Pinn-Woodcock, DVM, DACVIM

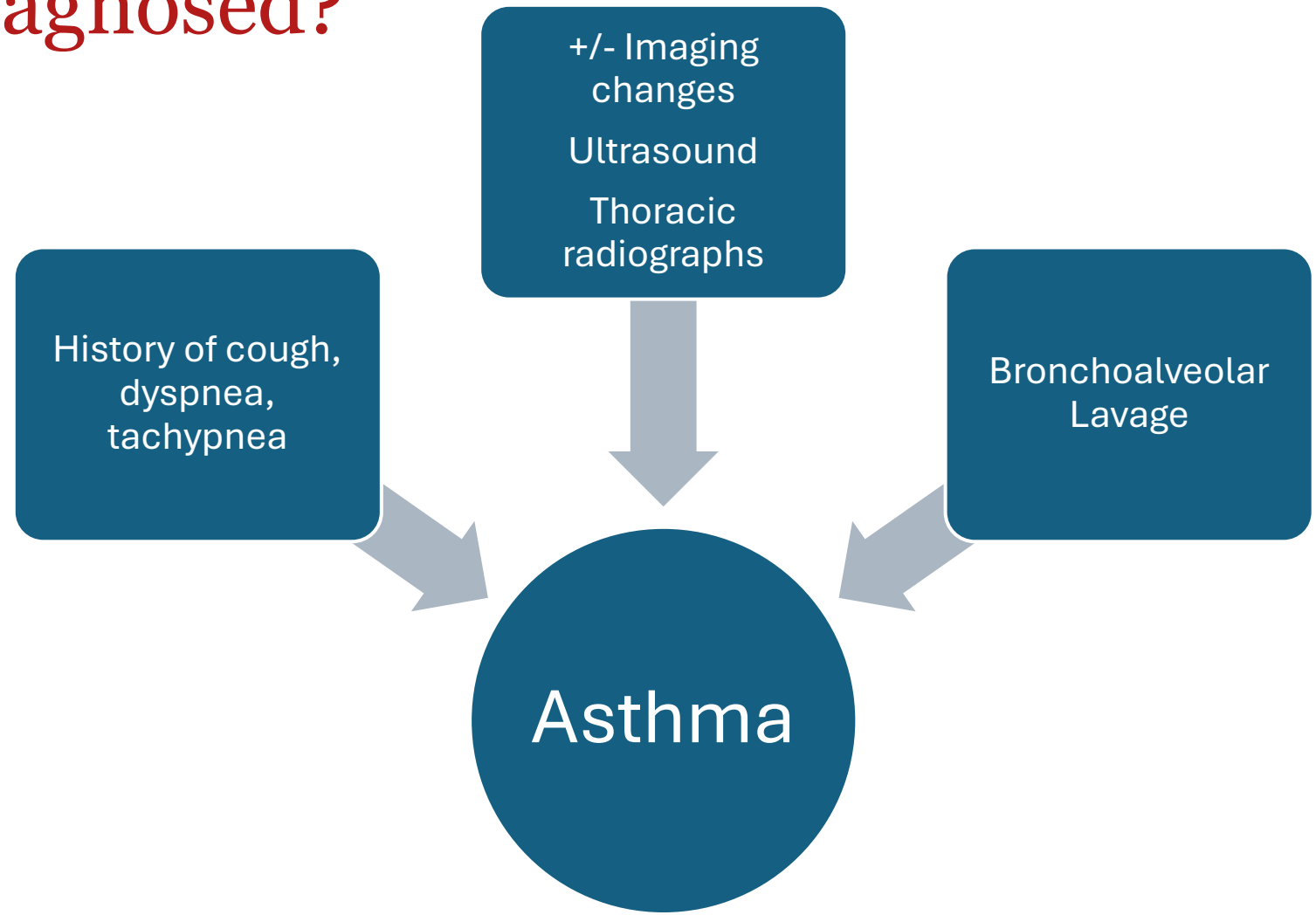
Associate Clinical Professor

Veterinary Support Services, Cornell AHDC

Clinician in Large Animal Internal Medicine, Cornell Equine Hospital

College of
Veterinary Medicine

How is asthma diagnosed?



The work-up

- ✓ History
- ✓ Physical Exam
- ✓ Diagnostic Imaging
- ✓ Diagnostic Testing
  - Bloodwork, BAL, TW
- ✓ Management
  - Therapeutics
  - Environmental management
  - Follow-up

Common presenting complaints:

- Cough
- Exercise intolerance
- Increased respiratory effort
- Clinical signs resistant to usual management strategies

History

When do clinical signs occur?

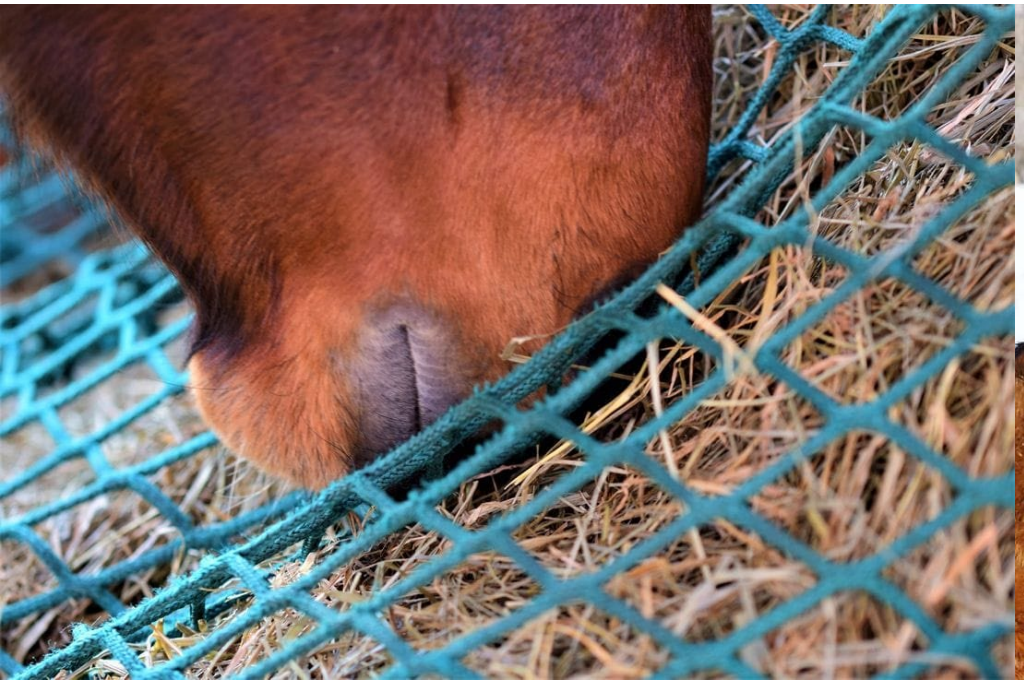
What does the cough sound like?

- Dry, productive, honking (tracheal collapse)

Seasonal?

History

Feeding routine



History

Housing style and turnout routine

History

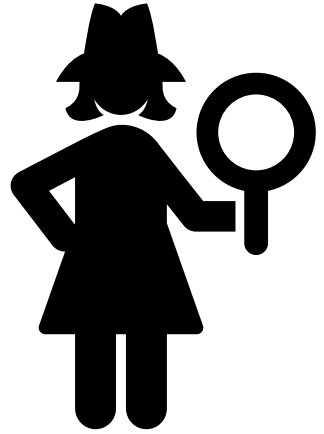
Identify management risk factors

History

Chronic vs. new acute problem?

Comorbidities – EMS, PPID, laminitis?

Case Example: 22yo Appendix QH mare



History

- 3yr history of chronic intermittent respiratory disease
- Particularly bad this year
- Signs reported at home:
  - Lowering the head
  - Couging during exercise
  - Occasional yellow to white creamy nasal discharge

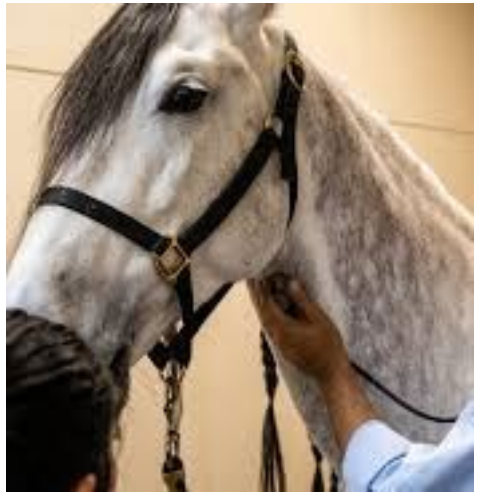
Prior Management

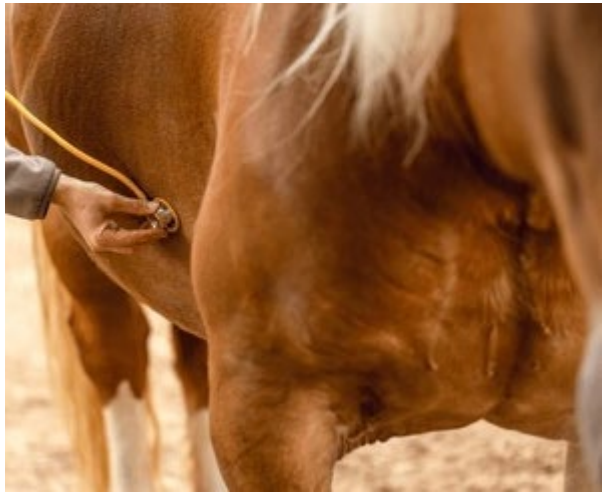
- Antibiotics
- Systemic dexamethasone
- Trihist
  - Pseudoephedrine HCl (decongestant)
  - Pyrilamine Maleate (anti-histamine)
- Aservo inhaler
  - Ciclesonide
  - No longer available
- Housed outside with round bales

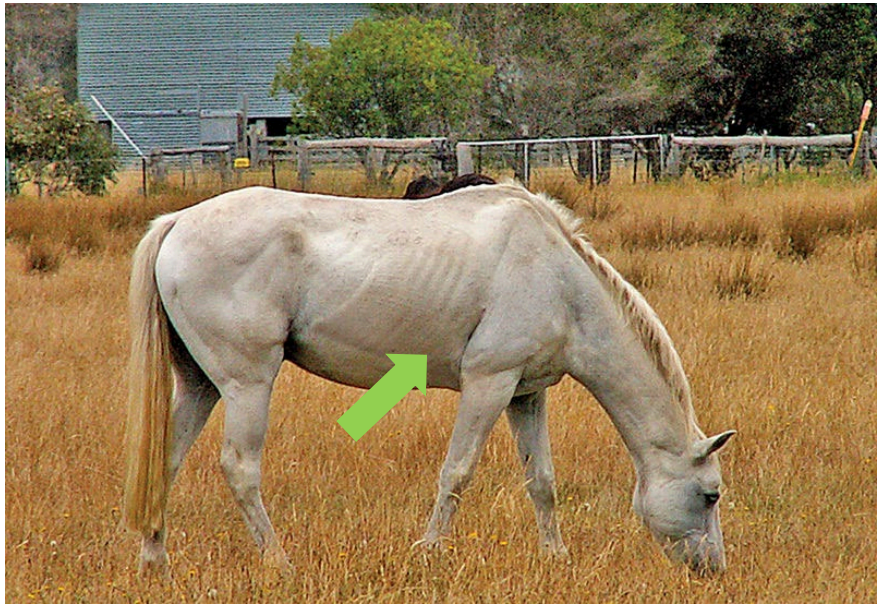
Physical Exam

Is this asthma?

- Heave line
- Increased bronchovesicular sounds, crackles or wheezes
- Tracheal rattle (mucous)
- Nasal discharge
- Inducible cough







Other differentials to consider during PE

Infectious respiratory disease (viral vs bacterial)

- Fever, purulent nasal discharge, feed material in nostrils (aspiration), lymphadenopathy

Heart disease

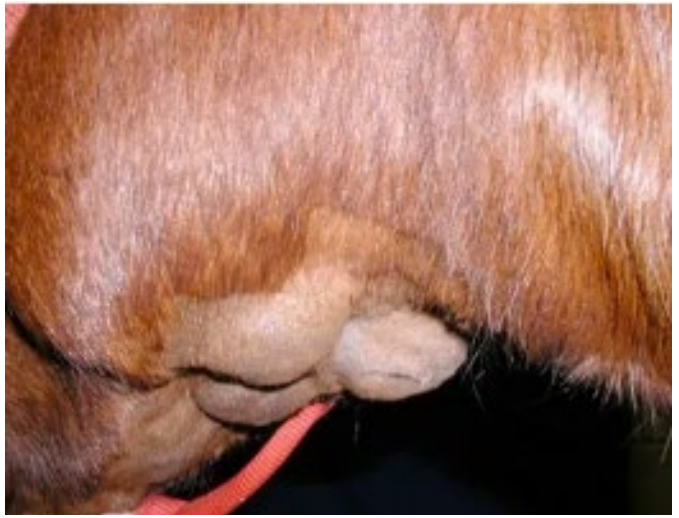
- Murmur or arrythmia

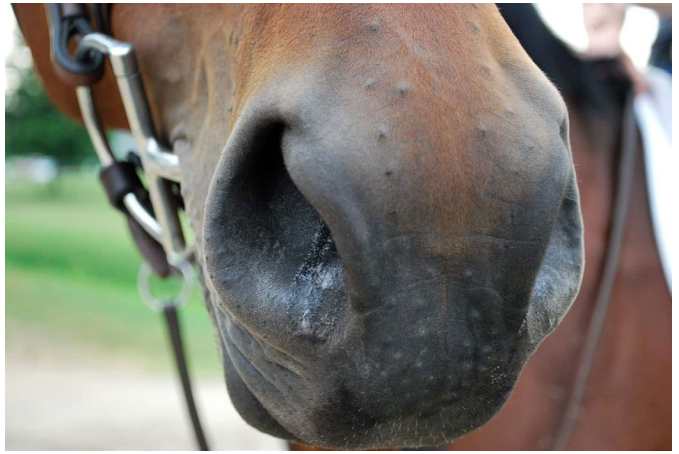
Equine multinodular pulmonary fibrosis

- Weight loss, fever, often refractory to treatment

Neoplasia

- Lymphadenopathy, weight loss, edema





Comorbidities to look for during PE

EMS

PPID

Laminitis

These comorbidities will impact your treatment plan

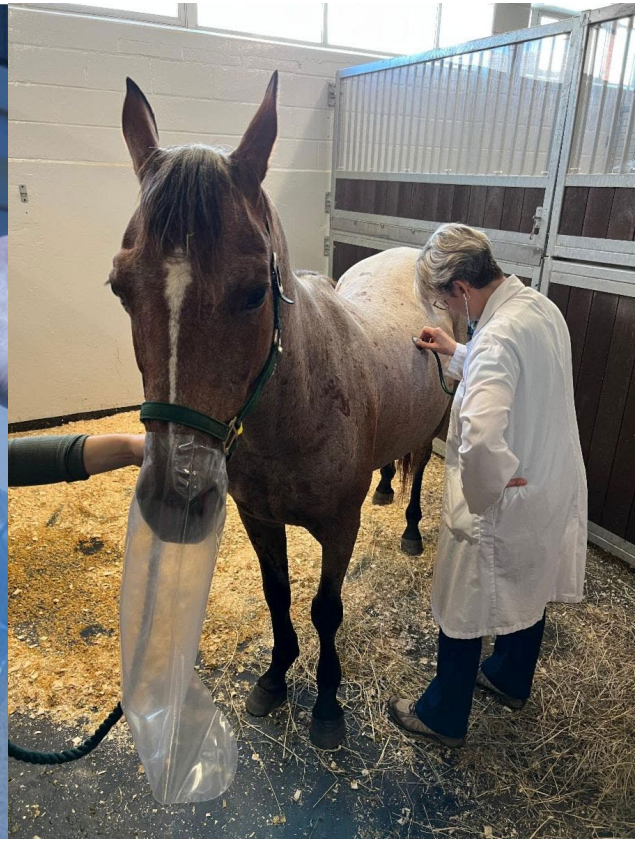
Rebreathing Exam

1. Hold bag over horse muzzle and away from nostrils

2. Remove bag after ~30+ seconds or sooner if horse becomes agitated

3. Auscult lung fields after removing bag, while horse takes deep breaths

4. Repeat as needed to examine all lung fields bilaterally



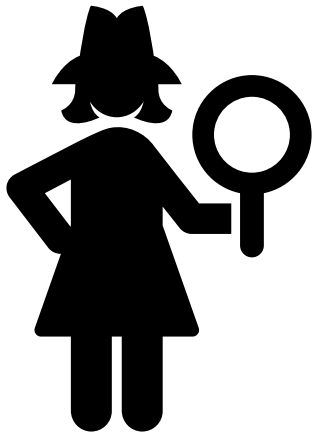
Back to case example…

Physical Exam

- Mild expaxial muscle wasting
- BCS 5/9
- Scant mucous in nares
- Pulmonary auscultation:
  - Lung sounds WNL
  - Increased tracheal sounds – slight rattle

Rebreathing Exam

- Quickly started breathing deeply
- No cough
- Did not elicit crackles/wheezes



Why run bloodwork?

Look for evidence of secondary bacterial infection

- CBC – neutrophilia, bands, toxic change
- Chemistry – hyperproteinemia, hyperglobulinemia
- Elevated SAA or fibrinogen

Investigate PPID and EMS

- ACTH
- Insulin
- Adiponectin

Assess Vitamin E and selenium

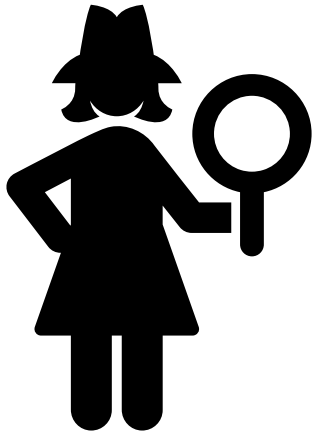
- Free radical scavengers
- Support immune function

Case example: bloodwork results

Unremarkable CBC and Chemistry

ACTH WNL

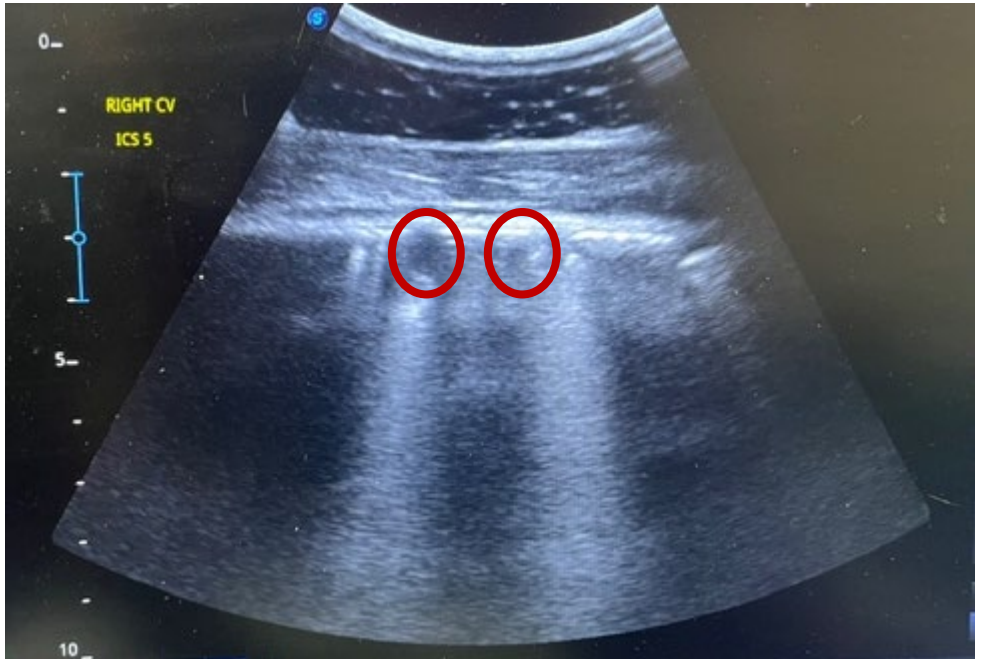
Insulin WNL



Diagnostic Imaging

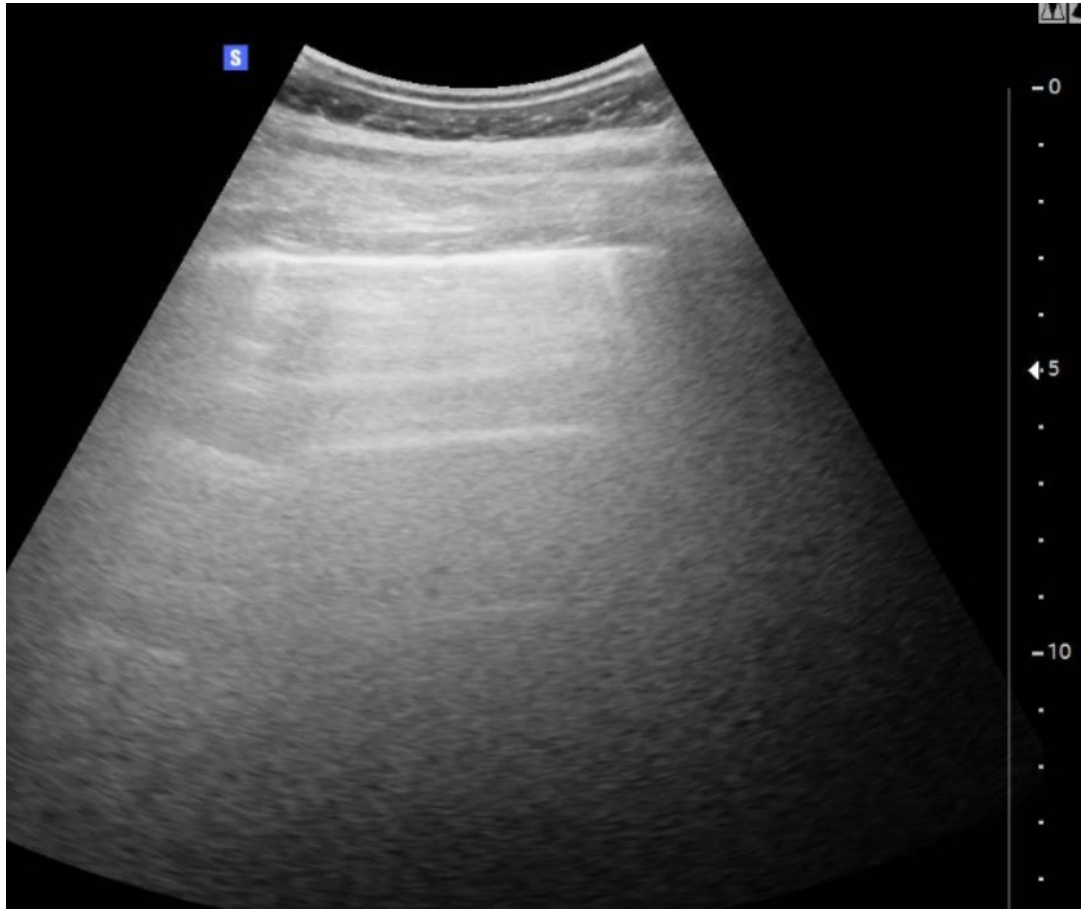
- Thoracic ultrasound
  - Pleural inflammation/roughening (B-lines)
  - Nodules or consolidation
  - Pleural effusion

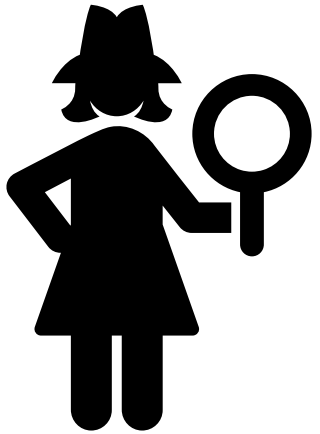
- Thoracic radiographs
  - Lesions deep to pleural surface
    - Bronchiolar and interstitial pattern with asthma
  - Masses, fibrosis



Case Example: Thoracic Ultrasound

B-lines indication pleural inflammation





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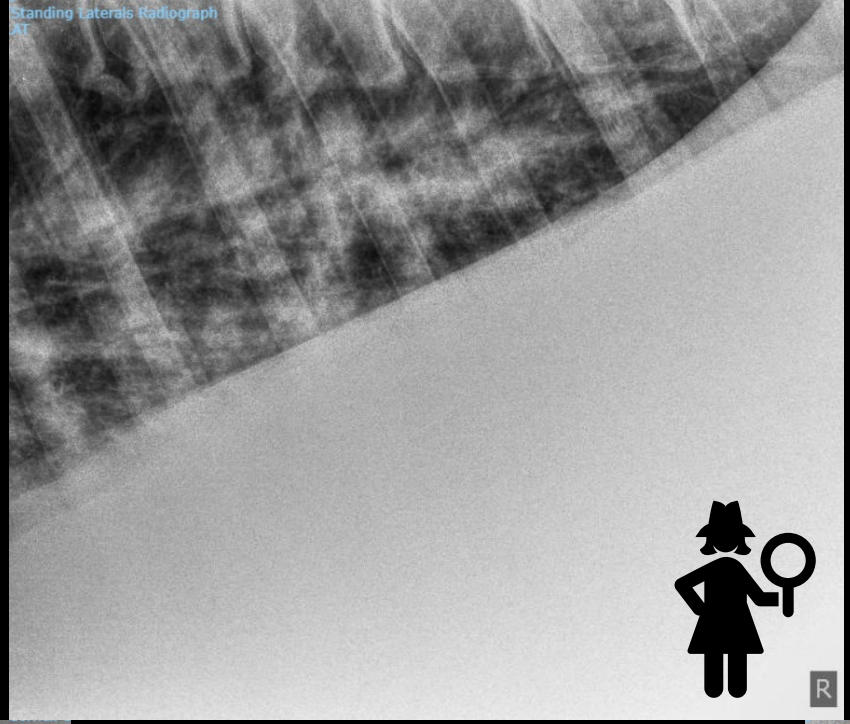
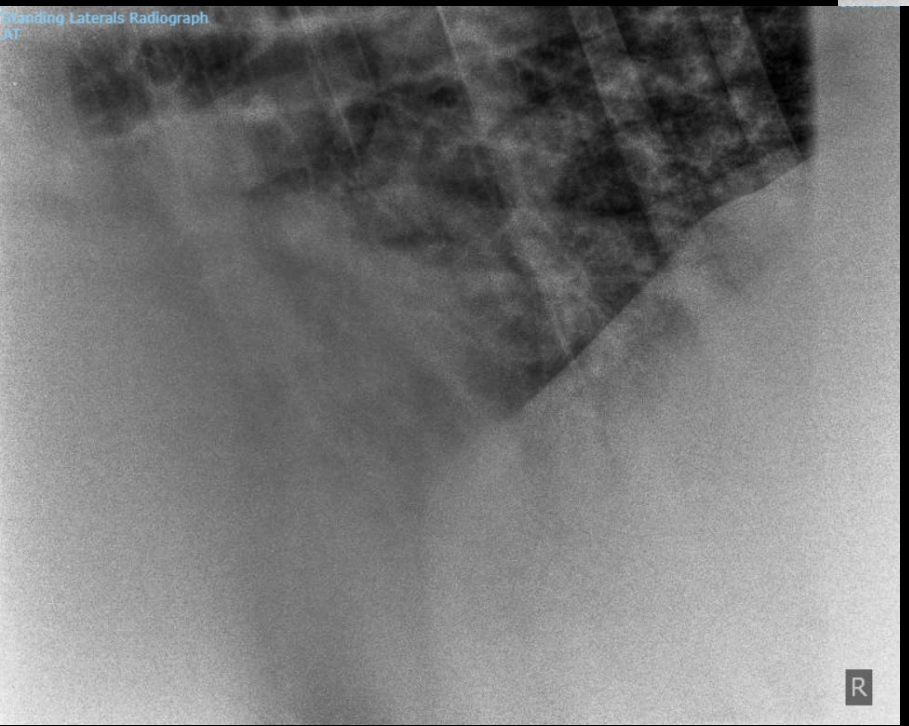
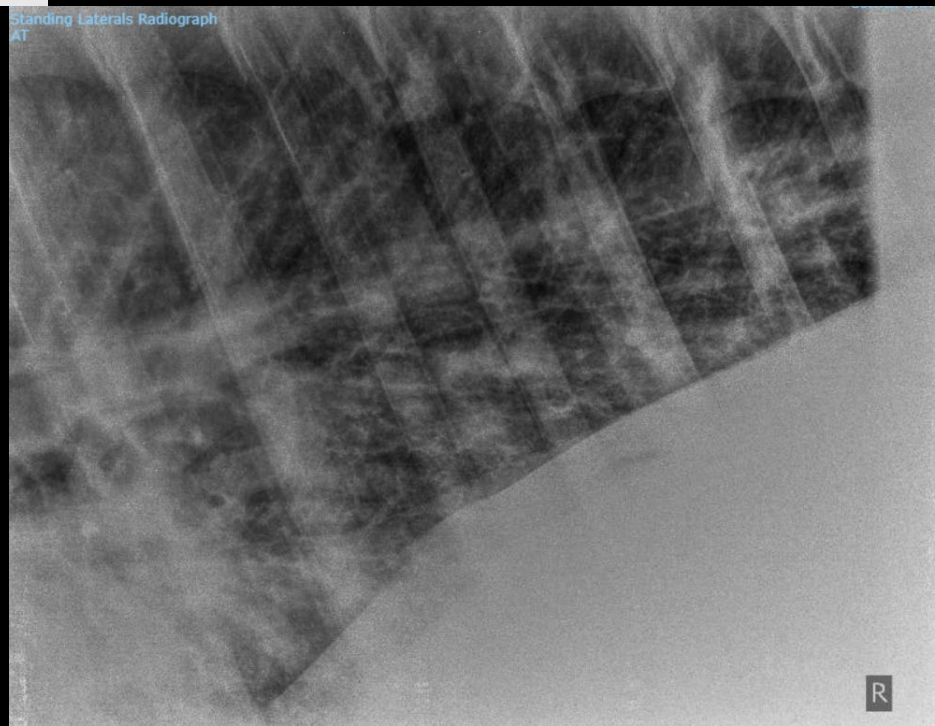
Bronchiolar and interstitial pattern







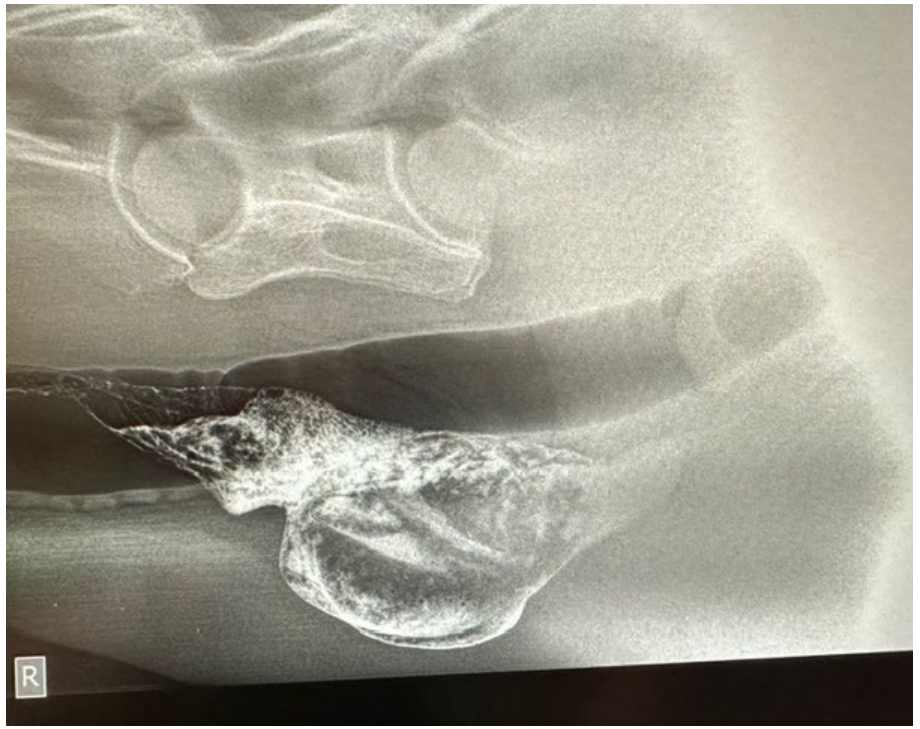
Airway endoscopy: What to look for

Unsedated:

- Pharynx – pharyngeal collapse
- Larynx –epiglottic entrapment, laryngeal hemiplegia, feed material

Sedated:

- Guttural pouches
- Sinus drainage
- Assess for mucous or feed material in trachea

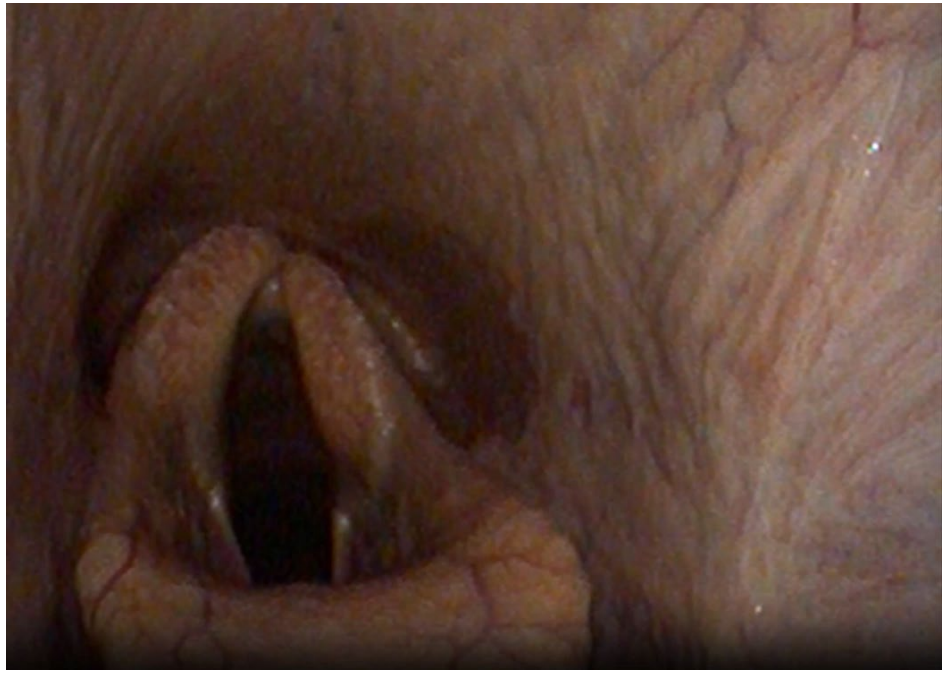


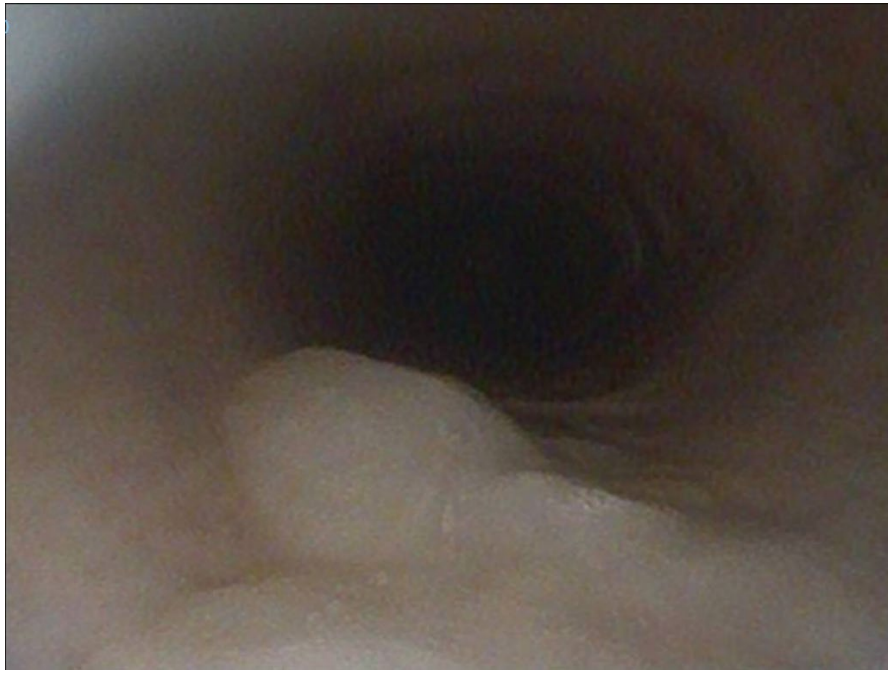
Geriatric horse with intermittent choke due to esophageal diverticulum and chronic cough associated with mild aspiration pneumonia

Case Example: Airway Endoscopy

Incidental left laryngeal hemiplegia (left image)

Mucous in trachea (right image)





Tracheal Wash vs. Bronchoalveolar Lavage

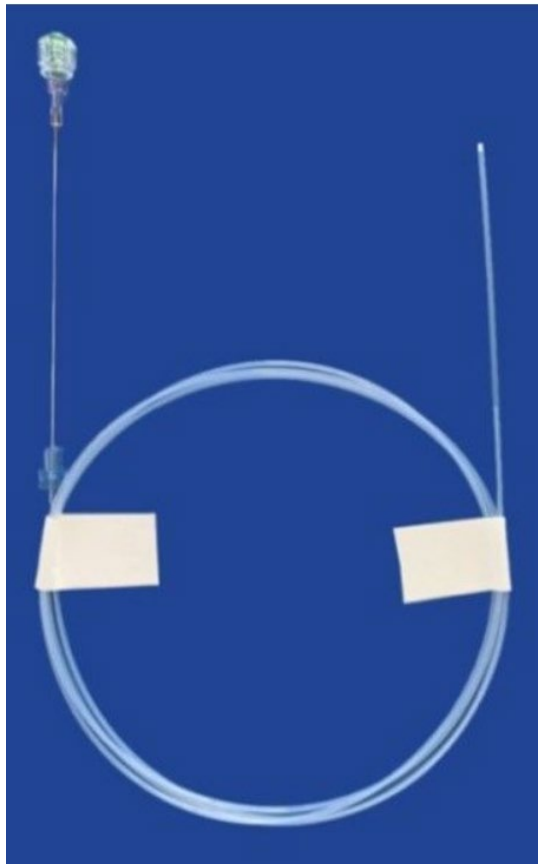
	Transtracheal Wash	Bronchoalveolar Lavage
Indication	Infectious Respiratory Disease Localized Disease	Non-Infectious Diffuse Disease
	*can have commensals (ie. trachea not sterile)	*fungal or Pneumocystis carinii
Culture	• Yes	No (sometimes)
Sterile	Yes	No
Cytology	Yes	Yes
Methods	• Trocar thru Neck • Guarded thru Endoscope	• BAL Tube • Endoscopic

*Perform tracheal wash before BAL if secondary infection is suspected

Practice Tip

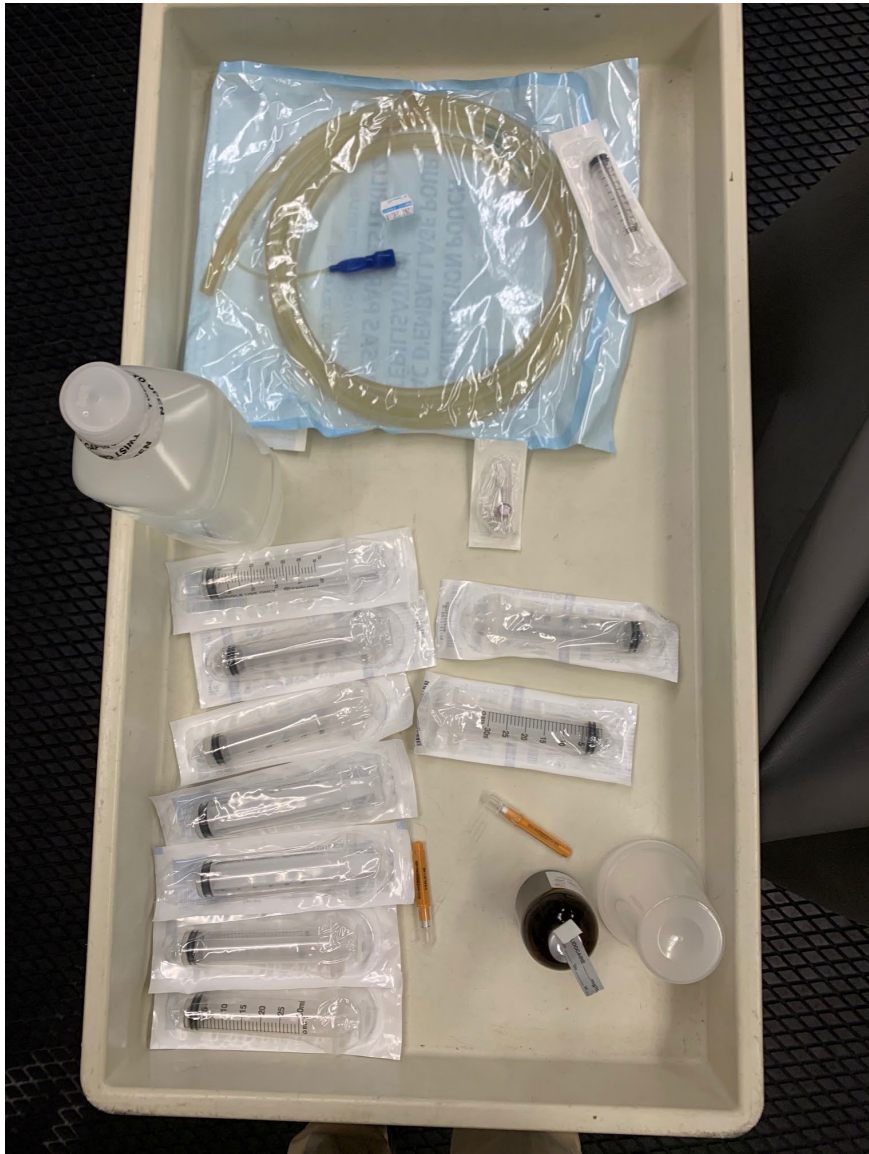
- If airway endoscopy is already part of your work-up and secondary bacterial infection is on your differential list, grab a trans-endoscopic tracheal wash sample.

- Supply list:
  - Mila double-guarded transendoscopic tracheal wash catheter
  - 30cc sterile saline
  - EDTA purple top tube for cytology
  - Red top tube for culture
  - Aerobic and anaerobic bacterial transport media



BAL Set-up

- Requires 3 people ideally
- BAL tube
  - Bivona 3m length, 11mm outside diameter
- EDTA purple top tube and glass slides
- 10 cc syringe to blow up cuff
- Lidocaine 2% 60-120 mL in 30-60-cc syringes
- 250 ml 0.9% saline
- 3-way stopcock
- 60 ml syringes (3-4)
- 1 specimen cup
- 18-gauge needle
- Sterile lubricant



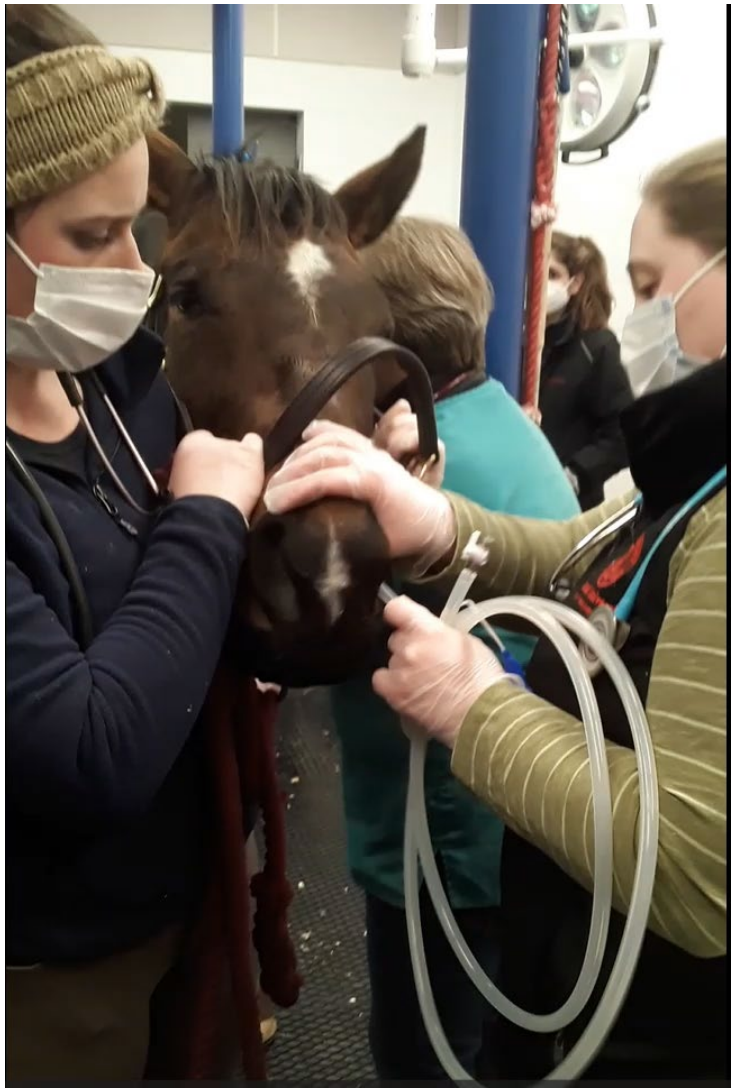
BAL Procedure – Step 1

- Check cuff on BAL tube
- Fill (4) 60 cc syringes with saline
- Fill (2) 30 cc syringes with lidocaine

- Sedate horse
  - Detomidine vs. xylazine
  - + Butorphanol (anti-tussive effects)

BAL Procedure – Step 2

- Restrain horse with head extended to facilitate passage of BAL tube into trachea
  - Expect horse to cough if in trachea, coughing validates proper placement
- Ensure BAL tube is within trachea by shaking trachea to feel ‘rattle’ – can feel BAL tube bouncing
- Administer lidocaine to reduce coughing
- Pass BAL tube until feel resistance indicating wedged in lower brochus, then inflate the cuff



BAL Procedure – Step 3

- Additional 30cc lidocaine can be infused after tube is wedged if horse continues to cough excessively

- Infuse 3-4x 60 ml syringes of sterile saline
  - Do not allow air to enter BAL tube between syringes by kinking or closing stopcock
  - After saline, infuse 60cc air to push saline through BAL tube

- Then, using same syringe, begin steady negative pressure
  - Withdraw fluid as long as it comes with gentle negative pressure
  - Stop if fluid transitions to blood-tinged
  - Foamy fluid is surfactant = good sample!

BAL Procedure

Expect to obtain ~30-50ml saline for each 60cc syringe infused
Saline left within bronchi will be absorbed

BAL Procedure – Removing BAL Tube

- Deflate cuff
- Remove with smooth stead motion

- BAL tubes can be re-used after cleaning and drying

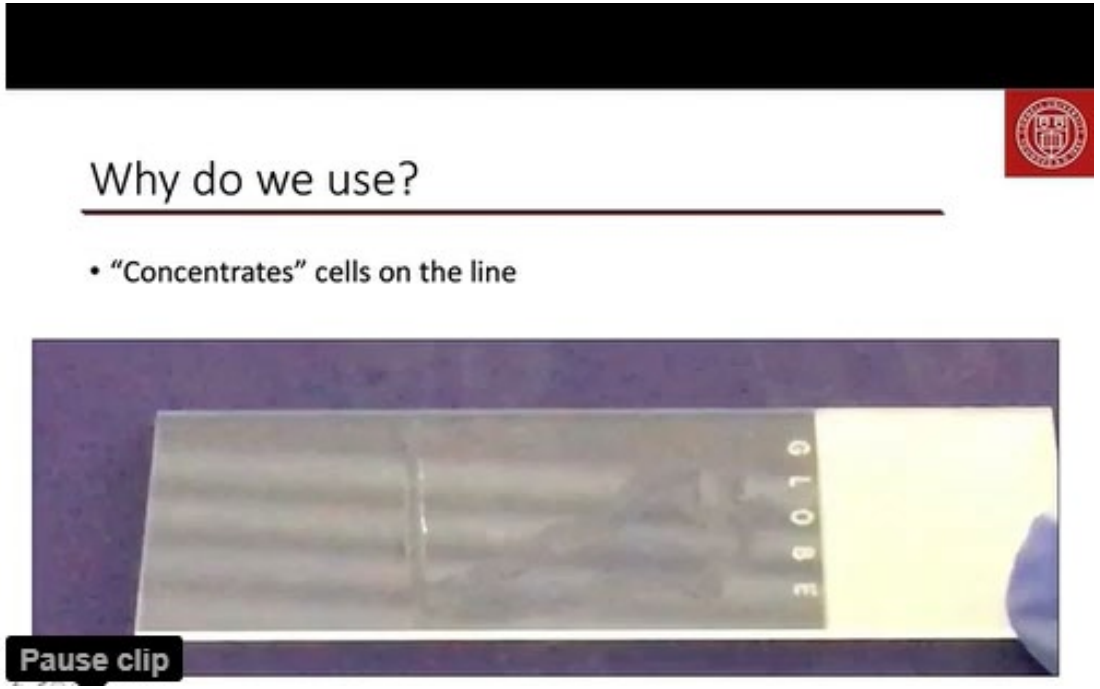
BAL Sample Handing

Transfer BAL fluid into sterile leak-proof container, such as a urine cup with a gasket or several red top tubes.

Prepare slides to send along with BAL fluid

BAL Slide Preparation

- Visit eClinPath.com for video tutorials - https://eclinpath.com/cytology/procedure-videos/
- Classic wedge smear if you have a centrifuge
- Line smear if you are unable to centrifuge
- Submit 2-3 slides unstained with BAL fluid for cytology (protect in rigid container or slide holder)



BAL Interpretation

- Asthma:
- >5% neutrophils
- >2% mast cells
- >1% eosinophils

- ‘foamy’ macrophages are associated with the presence of EHV5

Case Example: BAL Results

Description: Direct and cytocentrifuge smears prepared from the submitted colorless and mildly opaque fluid are examined. The direct smear of the residue consists of a moderate amount of mucus with numerous non-degenerate neutrophils and few macrophages. The cytospin smears are moderately cellular consisting of leukocytes in approximately the following proportions: 48% non-degenerate neutrophils, 36% macrophages (including rare multinucleated giant forms), 12% small lymphocytes, 3% mast cells, and 1% eosinophils. There are rare green to blue dematiaceous fungal spores, some of which are adhered to the macrophages (environmental contaminants). Rare respiratory columnar epithelial cells and individual goblet cells are seen. No infectious organisms or overtly neoplastic cells are seen. There is a small amount of hemosiderin noted on the Prussian blue stain.

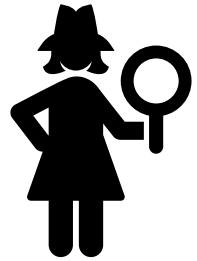
Interpretation:
Moderate mixed inflammation (predominantly neutrophilic, macrophagic, mastocytic)
Prior hemorrhage

Comment: The cytologic findings along with the clinical presentation are compatible with equine asthma. Bacterial culture would be worthwhile to help rule out an infectious component, given the numerous neutrophils entrapped in mucus on the filtered material. The small amount of hemosiderin seen indicates a mild degree of prior hemorrhage.

Case Example: Asthma +/- secondary bacterial infection

Cell populations – Moderate mixed inflammation

- 48% non-degenerate neutrophils
- 36% macrophages; 12% lymphocytes
- 3% mast cells
- 1% eosinophils



No neoplastic cells

Infectious agents

- Fungal spores adhered to macrophages – environmental contaminants
- No infectious organisms but due to high number neutrophils, recommend culture to rule out infectious component
  - Given the normal bloodwork, clinicians elected not to pursue culture

Treatment of Asthma

Requires multi-pronged approach:

- **Environmental management changes**

- Oral systemic steroid taper over 28 days
  - Dexamethasone: beginning at 0.1mg/kg and reducing dose by 20% every 4-5 days
  - Oral dexamethasone is ~60% bioavailable
  - Prednisolone is not as effective

- Oral bronchodilator clenbuterol (Ventipulmin)
  - 0.8 ug/kg PO BID for 2 weeks
  - Receptors become refractory beyond this duration of treatment

- Period of rest from forced exercise (~1 month), followed by slow re-introduction

Treatment of Asthma: Case Example

Dexamethasone taper example: 1000lb horse

- **Dexamethasone injectable solution (2mg/ml) tapering dose given orally**
- 40mg (20ml) By mouth once a day for three days
- 34mg (17ml) By mouth once a day for four days
- 30mg (15ml) By mouth once a day for four days
- 24mg (12ml) By mouth once a day for four days
- 20mg (10ml) By mouth once a day for four days
- 20mg (10ml) By mouth once every other day for four treatments
- 10mg (5ml) By mouth once every other day for four treatments

- **Side effects include:** Laminitis (lameness, increased digital pulses), GI upset, and lethargy. Please contact your regular veterinarian if you see any of these signs.

Environmental Management

Turnout

- Provide as much turnout as possible
- If must be in barn, use a well-ventilated stall- near a door or windows and away from the hay storage.

Environmental Management

Feeding

- Feed hay off the ground; avoid round bales

- Wet hay thoroughly and feed from the ground.
  - Soak hay in water for 5 minutes and then drain before offering or use a hay steamer

- Avoid hay nets or hay bins because they encourage the horse to stick the muzzle into a confined, dust-filled area

- Omega-3 polyunsaturated fatty acid supplement

Environmental Management

Bedding

- Avoid dusty sawdust and straw bedding

- Well-dried wood chips or cardboard bedding are the best types for low dust

- Avoid stabling near other horse stalls bedded with straw

Environmental Management

More tips for reduced dust/allergen exposure

- Do not use air blowers in stables or avoid bringing back in the stall for at least one hour after using a blower.
- Do not leave tractors idling in stables and sprinkle aisles with water before raking.
- Avoid turnout/riding in dusty arenas

Asthma management in patients with PPID, EMS

Optimize environmental management

Optimize control of PPID and insulin dysregulation

- Pergolide
- Ideal BCS
- Ideal diet – low in NSC
- Ideal hoof care
- +/- SGLT2 Inhibitors

Asthma management in patients with PPID, EMS

Inhaled steroids instead?

Inhaled bronchodilators?

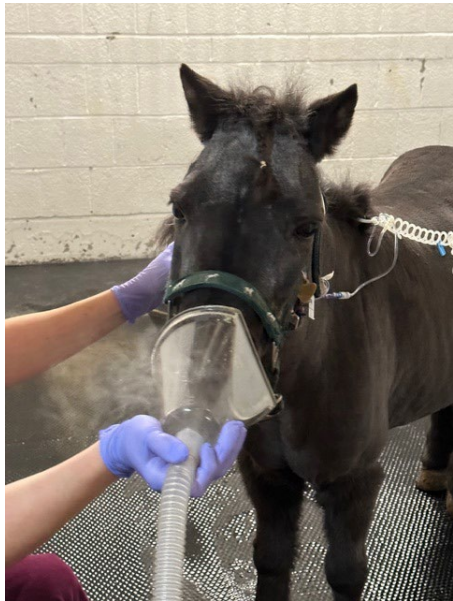
- Flexineb
  - Use injectable dexamethasone – low cost
  - Liquid albuterol
  - Research does not support efficacy for steroid delivery to lungs

- Aerohippus/Equihaler for metered-dose inhalers (MDI)
  - MDIs are expensive
  - Consider for maintenance

Managing an Asthma Crisis

- **Buscopan** (N-butylscopolammonium bromide)
  - 0.2-0.3mg/kg IV or IM
  - Anti-cholingergic bronchodilator – 1hr duration
  - Adverse effects – transient tachycardia, decreased GI motility

- **Bronchodilator**
  - Inhaled albuterol – 1ug/kg, can repeat hourly in a crisis
    - Effects lasting ~4hr
    - Beta-adrenergic bronchodilator via nebulizer or MDI
    - Oral clenbuterol – 0.8 ug/kg PO q12hr



- **Systemic corticosteroids**
  - Dexamethasone IV or IM (0.05-0.1 mg/kg) – most effective
  - Prednisolone PO (1-2 mg/kg)
  - Laminitis risk in horses with insulin dysregulation (PPID, EMS)

Inhaled Steroids and Bronchodilators

Morales, CJ and Costa LR. Chonic Cough and Hyperpnea. 2024. VCNA

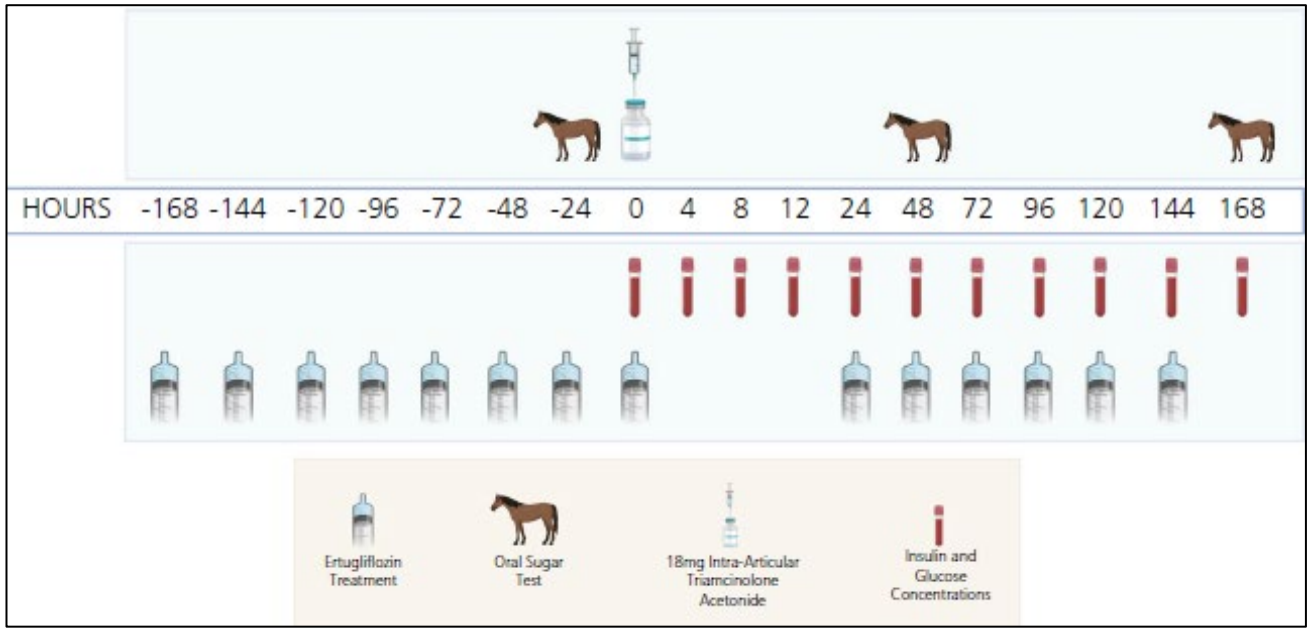
Drug Name	Dose	Function
Albuterol	1 ug/kg q6-12hr	Bronchodilator Recommended 15min prior to administering inhaled corticosteroid.
Salmeterol	0.25-1 ug/kg q6-8hr	Bronchodilator
Ipatropium	0.2-0.4 ug/k q8-12hr	Bronchodilator
Fluticasone	4-6 ug/kg q12hr inhaled via MDI	Corticosteroid
Beclomethasone diproprionate	7 ug/kg q12hr inhaled via MDI	Corticosteroid
Budesonide	1800 ug q12hr inhaled via MDI	Corticosteroid

Administer using MDI with Aerohippus, Equihaler or Flexineb

Asthma management in patients with PPID, EMS

Page et al. EVJ. January 2026.

Treatment with ertugliflozin mitigates the hyperinsulinemic response to intra-articular triamcinolone acetonide



Conclusions: Treatment with ertugliflozin decreases glucose and insulin changes following IA corticosteroid administration in metabolically normal horses. Further investigation of this treatment strategy in insulin dysregulated horses is warranted as it may reduce hyperinsulinemia and, therefore, the risk of laminitis with IA corticosteroid administration.

Other diagnostic and treatment tools?

Intradermal skin testing

- Canine dander
- *Dermatophagoides* spp
  - Dust and grain mites
- Insects

➢Management changes

➢Desensitization shots

Nebulized alpha-2 macroglobulin

What is alpha-2 macroglobulin?

- Plasma protein produced by liver
- Protease inhibitor
- Cytokine inhibitor

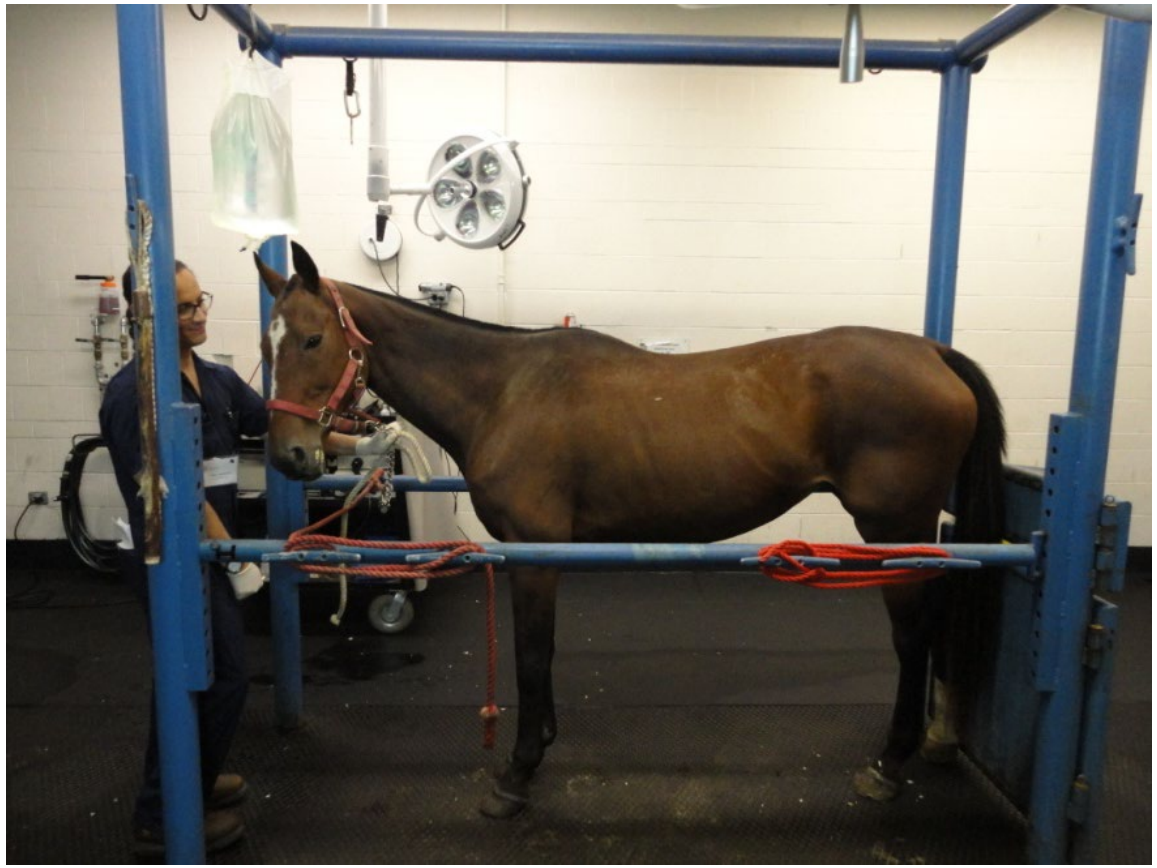
➢Research ongoing

➢Anecdotal positive results

Another case example: 16yo THB mare

Polo pony

- Chief complaint of exercise intolerance, history of asthma
- Initial physical exam – tachypnea and fever
- Treated with systemic antibiotis and NSAIDs
- Weight loss developed, fever and tachypnea returned



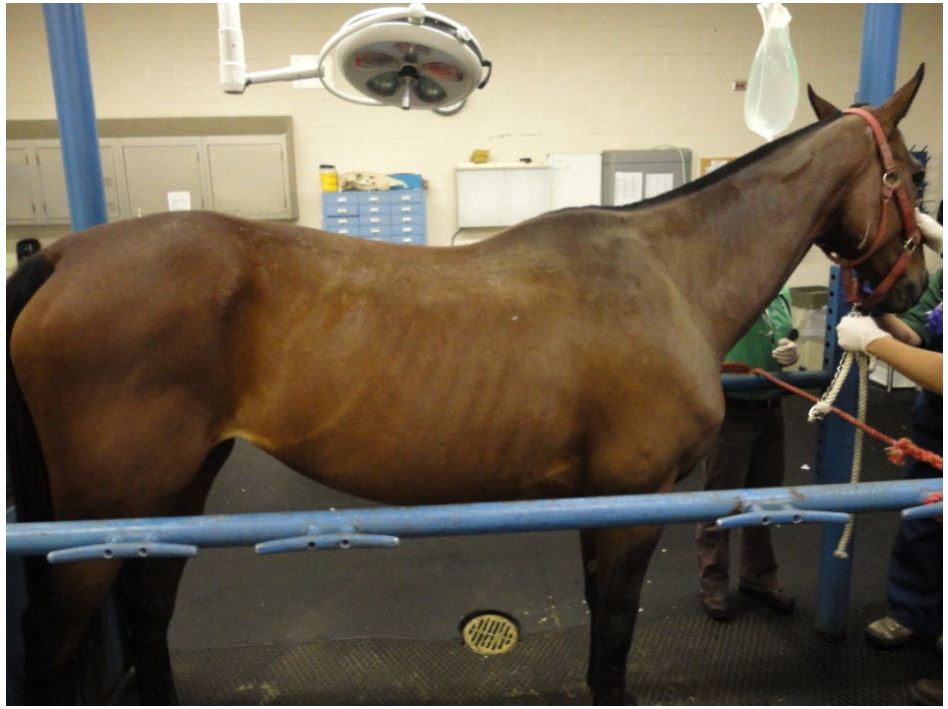
Case example: 16yo THB mare

Temp 102, HR 60, RR 44

BCS 3/9

Thoracic auscultation
- Diffusely harsh lung sounds bilaterally
- Crackles mid thorax bilaterally
- Wheezes cranioventrally bilaterally

No nasal discharge



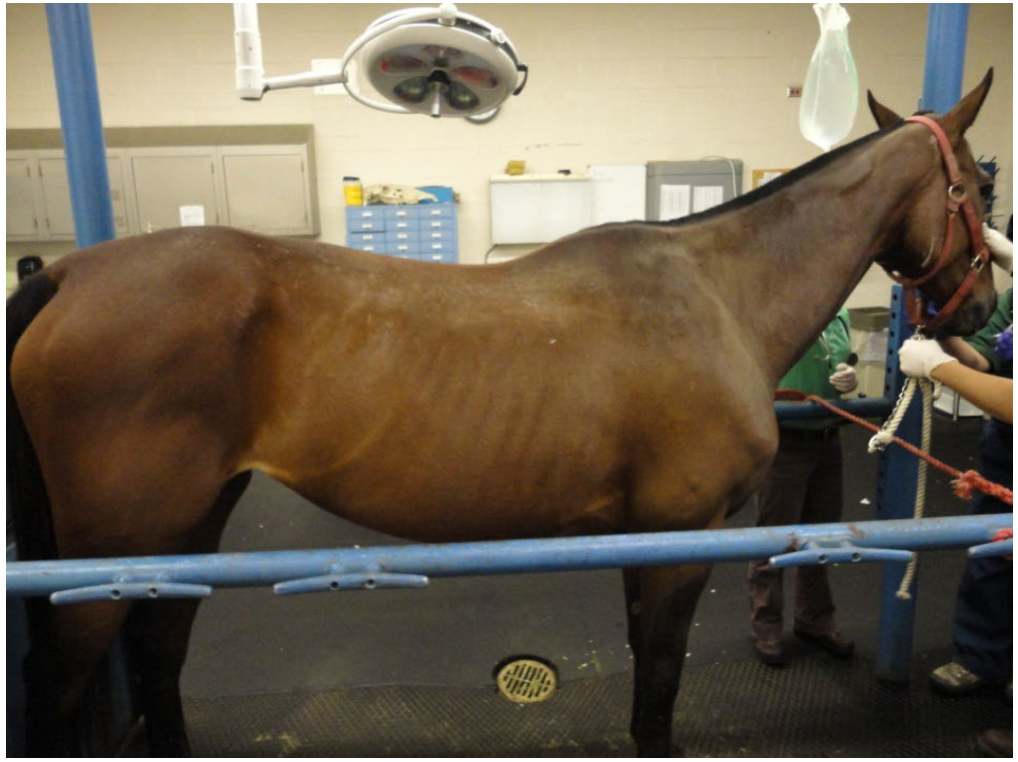
Case example: 16yo THB mare

CBC: Leukocytosis (19,000 /uL)

- Moderate mature neutrophilia (15,800/uL)
- Mild monocytosis (1,100 /uL)
- Mild basophilia (400 /uL)

Chemistry

- Total Protein 7.3 g/dL
  - Albumin 2.9
  - Globulin 4.4



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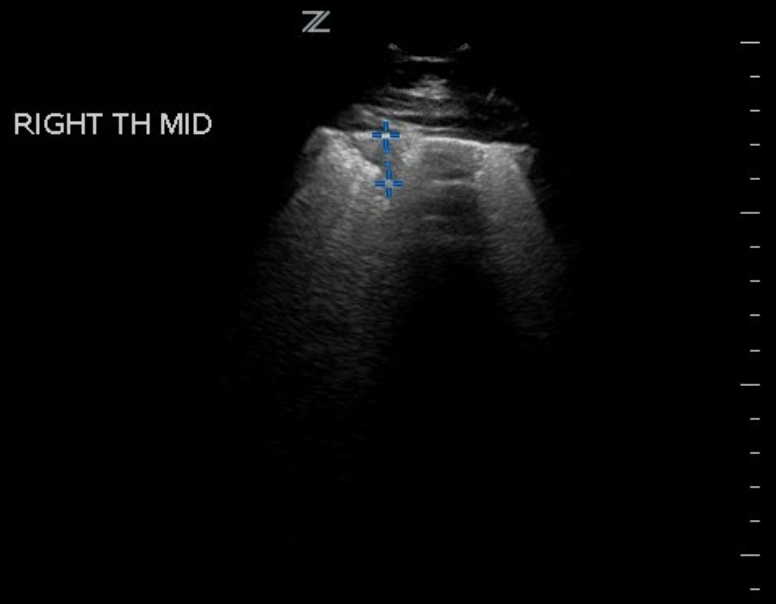
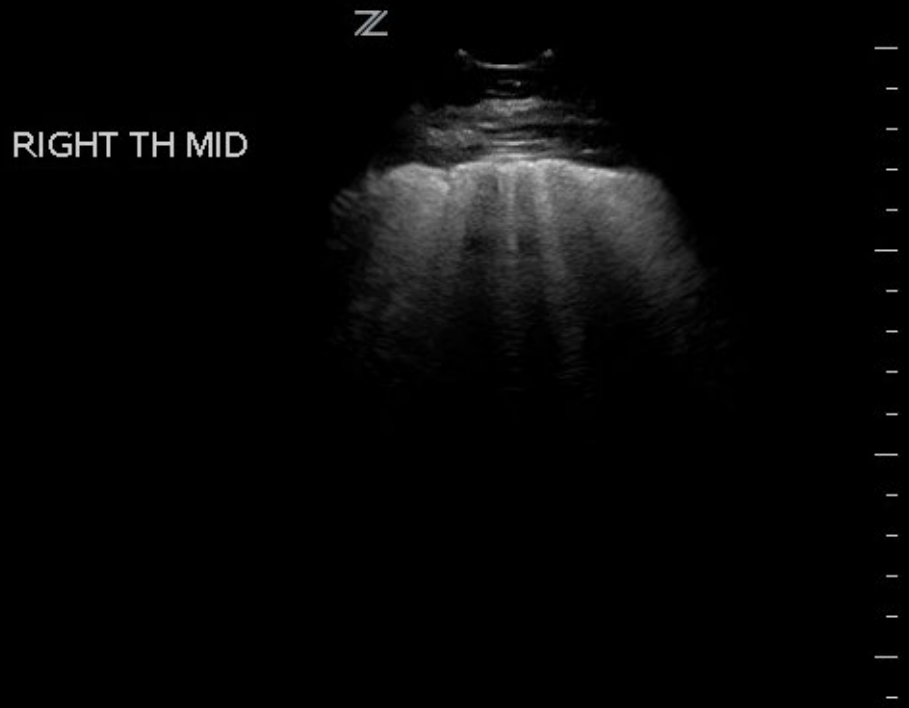
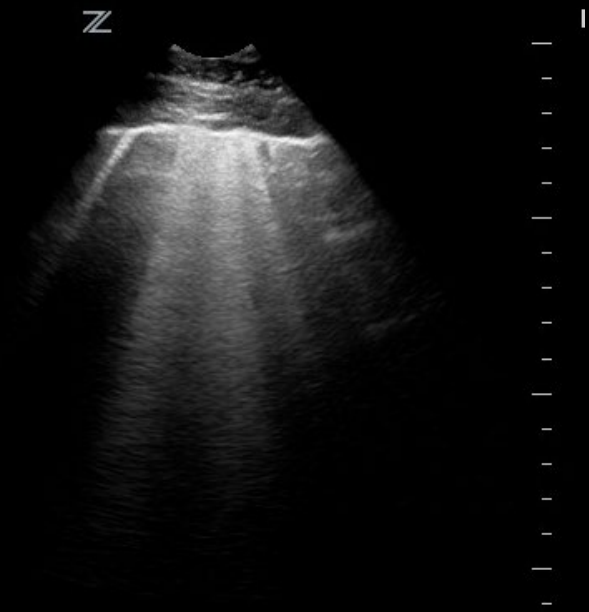


Dist 1: 1.43cm





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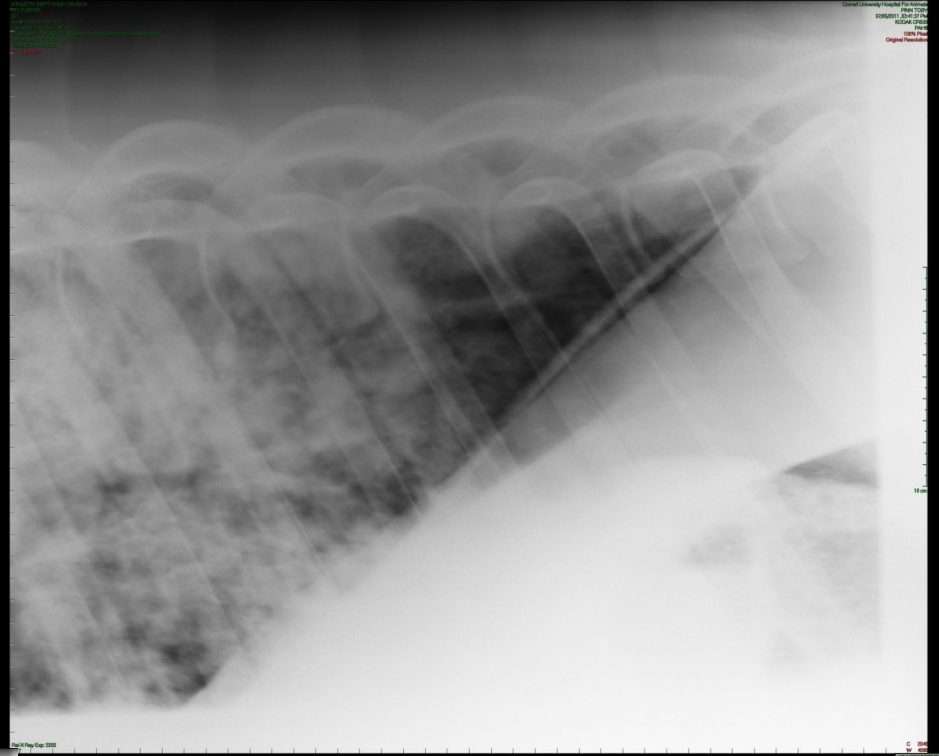
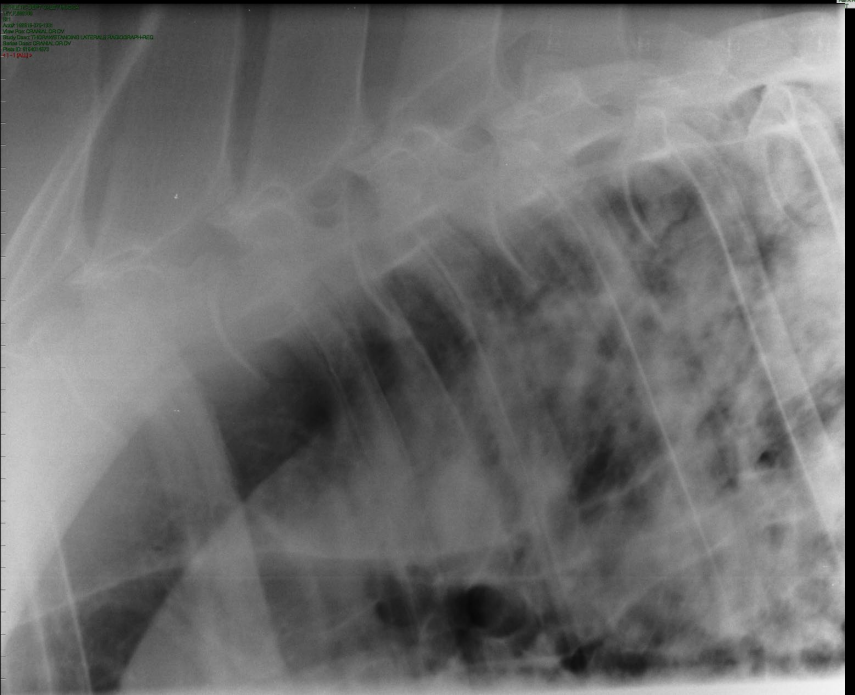
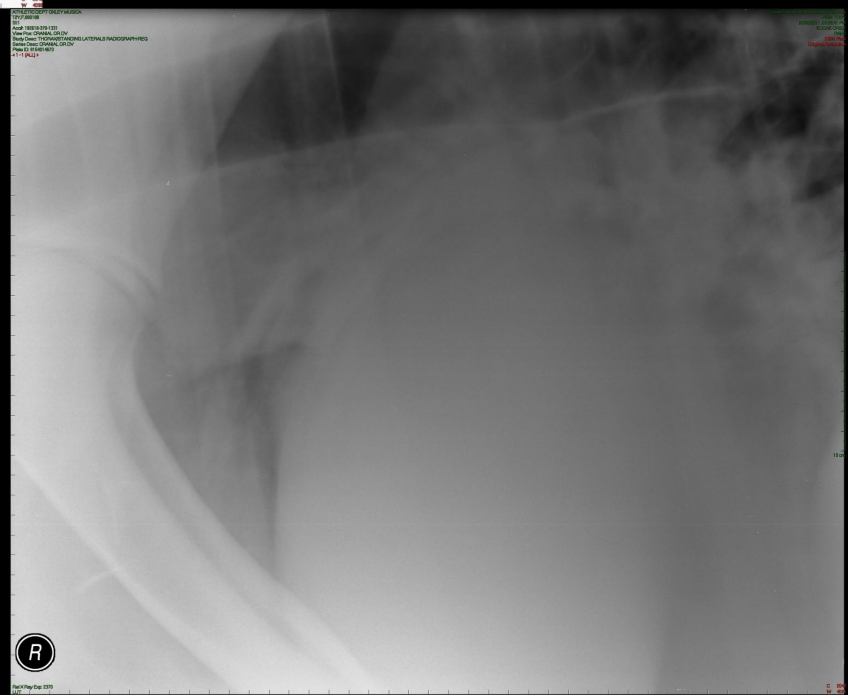




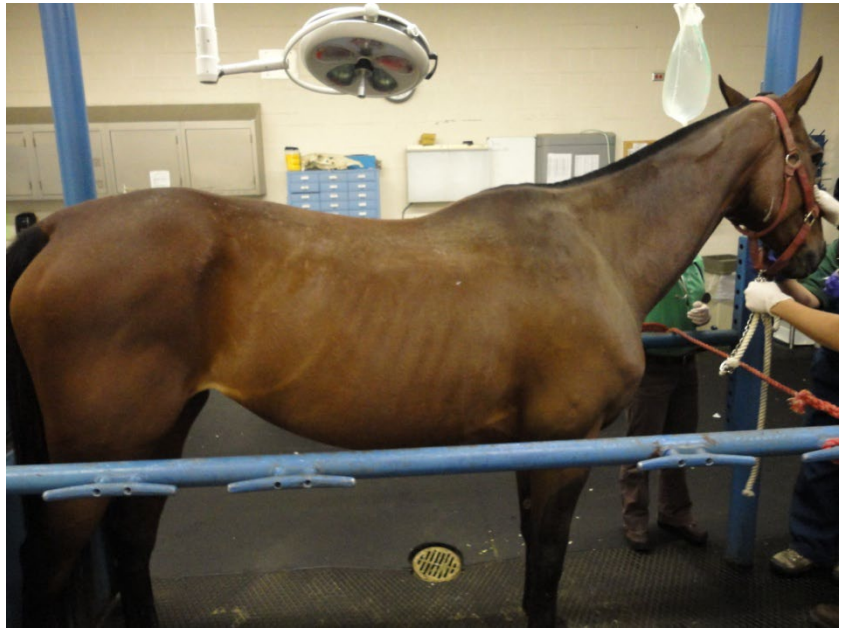


Another case example: 16yo THB mare

Bronchoalveolar Lavage

- Nucleated cell count 1345 /uL
  - 49% macrophages
  - 27% nondegenerate neutrophils
  - 23% small lymphocytes
  - 1% mast cells and rare eosinophils

- **EHV-5 PCR: POSITIVE**

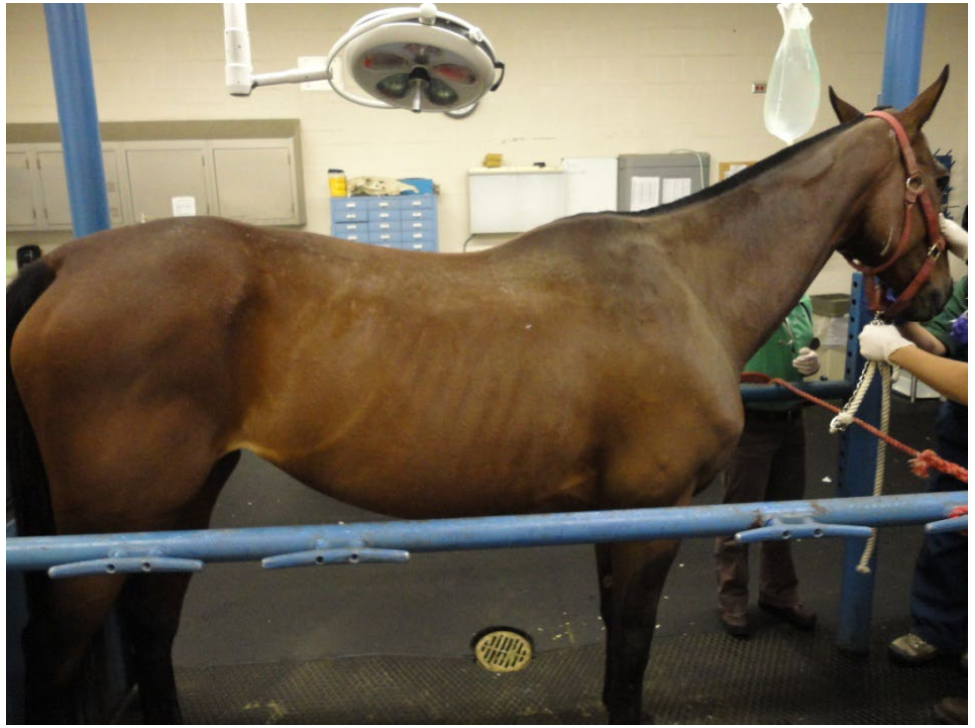


Case example: 16yo THB mare

Transendoscopic tracheal wash

- Suppurative Inflammation:
  - 85-90% poorly preserved neutrophils
  - Hyperplastic respiratory epithelium
  - Rare round/oblong neutrophilic cytoplasmic pigmentation (bacteria?)
  - Mucous spirals

  - Culture (aerobic/anaerobic): No Growth



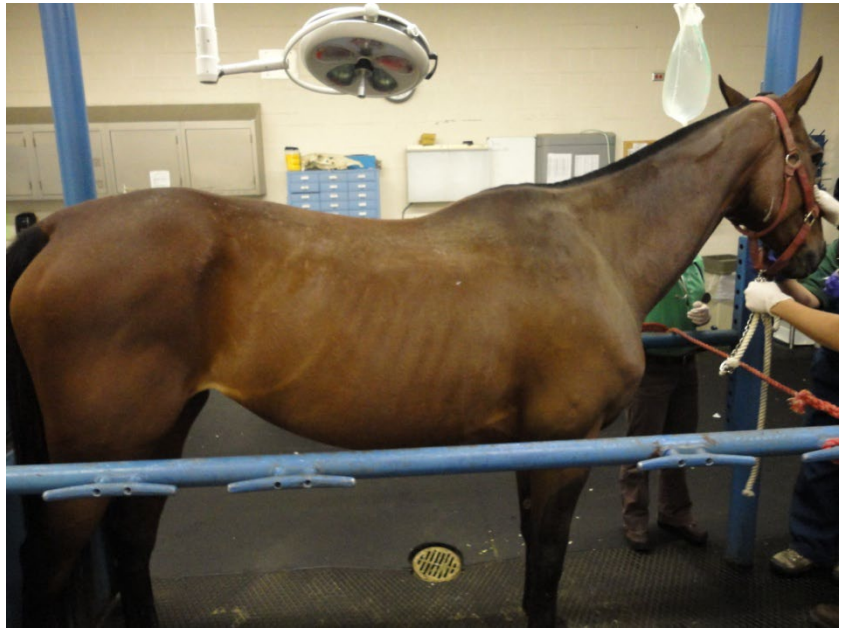
Case example: 16yo THB mare

- Chloramphenicol:
  - 44 mg/kg PO TID

- Dexamethasone taper following 3 days on chloro
  - Starting dose: 40mg IV SID for 3 days
    - 40mg PO for 3 days
    - 20% taper every 5 days (PO)

- Clenbuterol
- Gastrogard (preventative dose)
- Cool well-ventilated stall

Minimal response to treatment , poor quality of life - euthanized



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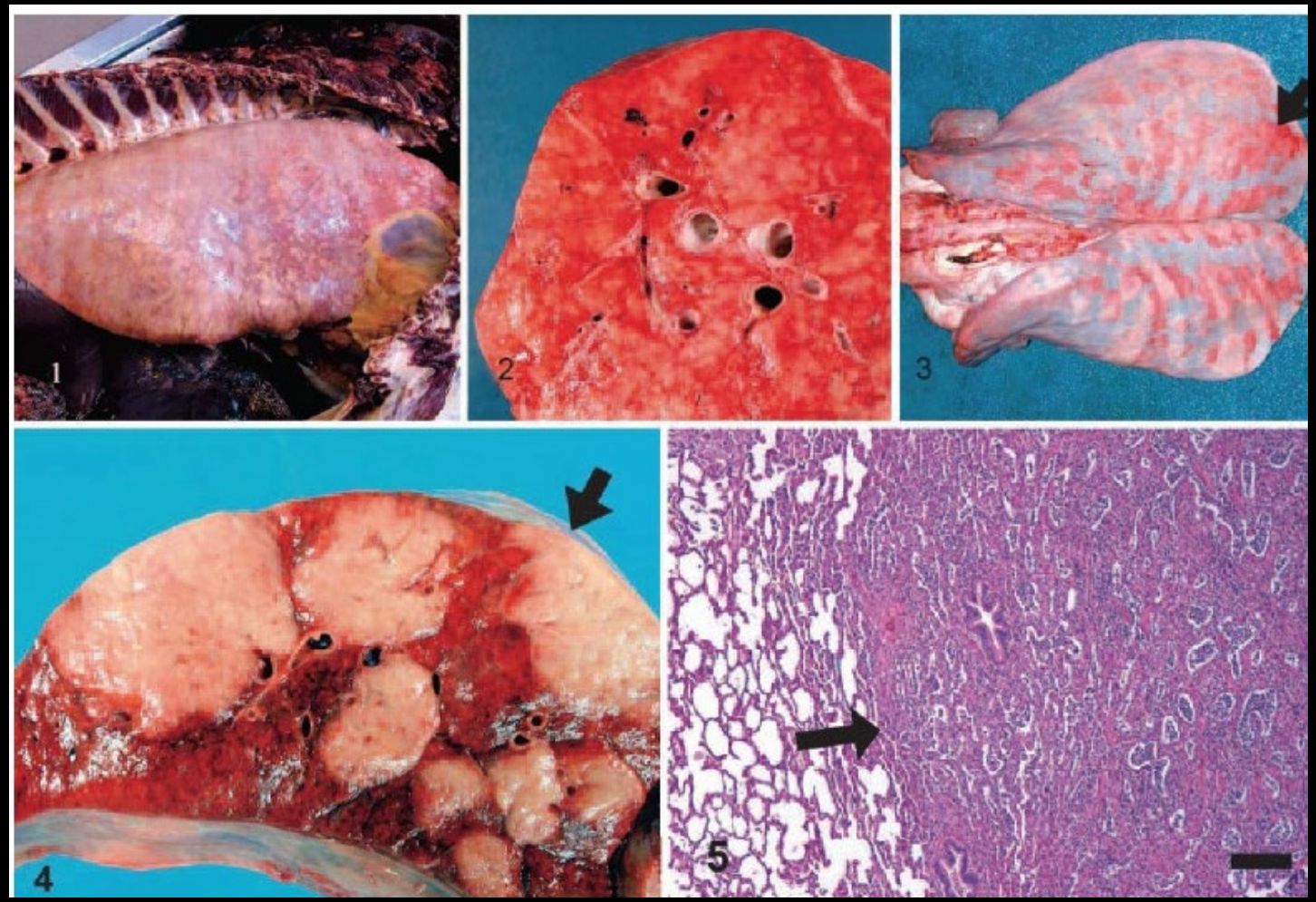
Equine Multinodular Pulmonary Fibrosis: A Newly Recognized Herpesvirus-Associated Fibrotic Lung Disease

K. J. Williams, R. Maes, F. Del Piero, A. Lim, A. Wise, D. C. Bolin, J. Caswell, C. Jackson, N. E. Robinson, F. Derksen, M. A. Scott, B. D. Uhal, X. Li, S. A. Youssef, and S. R. Bolin

Vet Pathol 44:849–862 (2007)



Images 1 & 2 diffuse form; Images 3 &4 discrete form

Thank you!
Questions?
tlp52@cornell.edu

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