Lower Respiratory Disease in Athletic Horses

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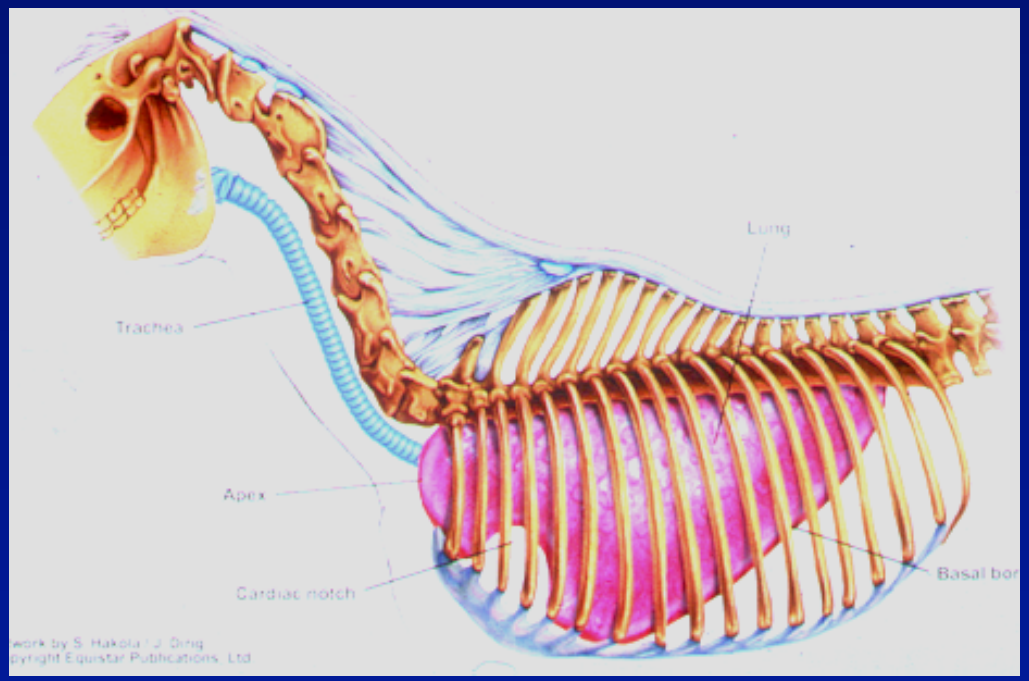
Outline

- Anatomy and function of the respiratory tract
- Inflammatory airway disease (IAD)
  - importance
  - causes
  - management
- Exercise-induced pulmonary hemorrhage
  - epidemiology
  - effect of nasal strips

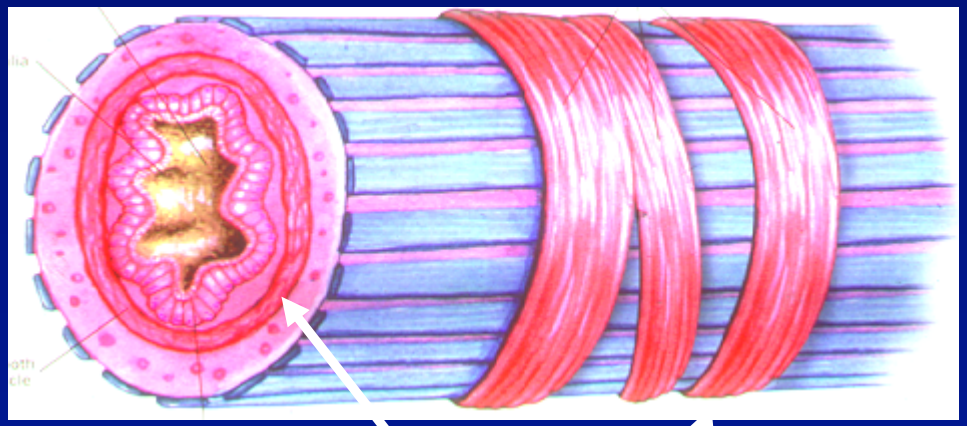
Anatomy

- Upper airway
  - nostrils, nasal passages, throat, trachea
- Lower airway
  - bronchi
  - brochioles
  - alveoli (air sacs)



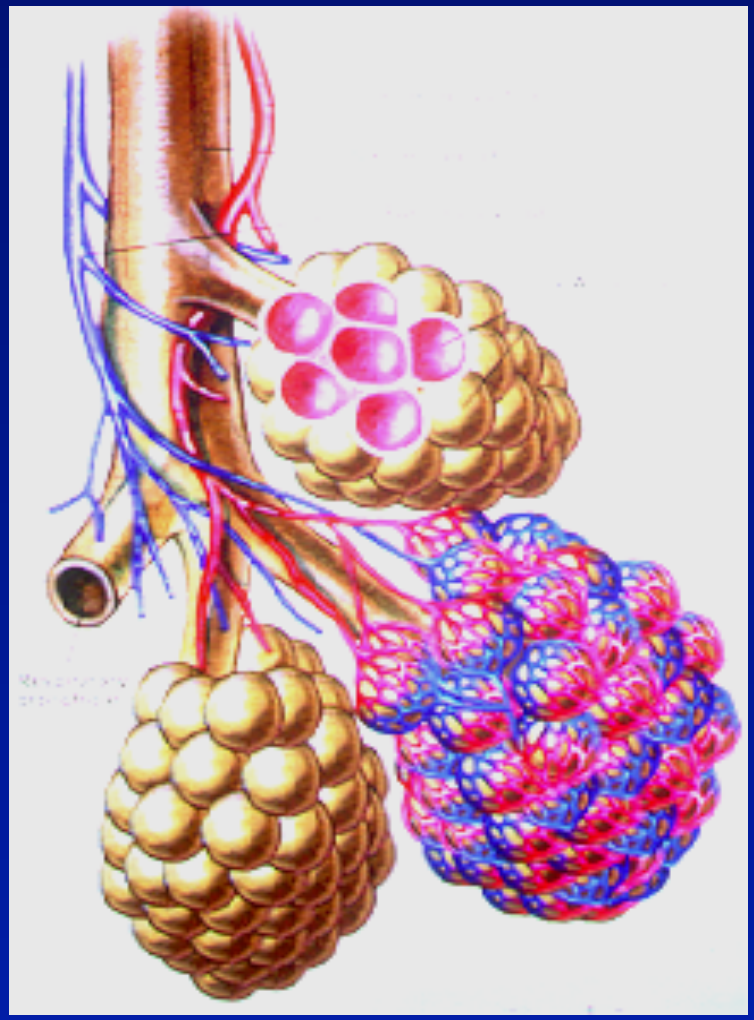
Anatomy: Bronchi/Bronchioles

Branching bronchi



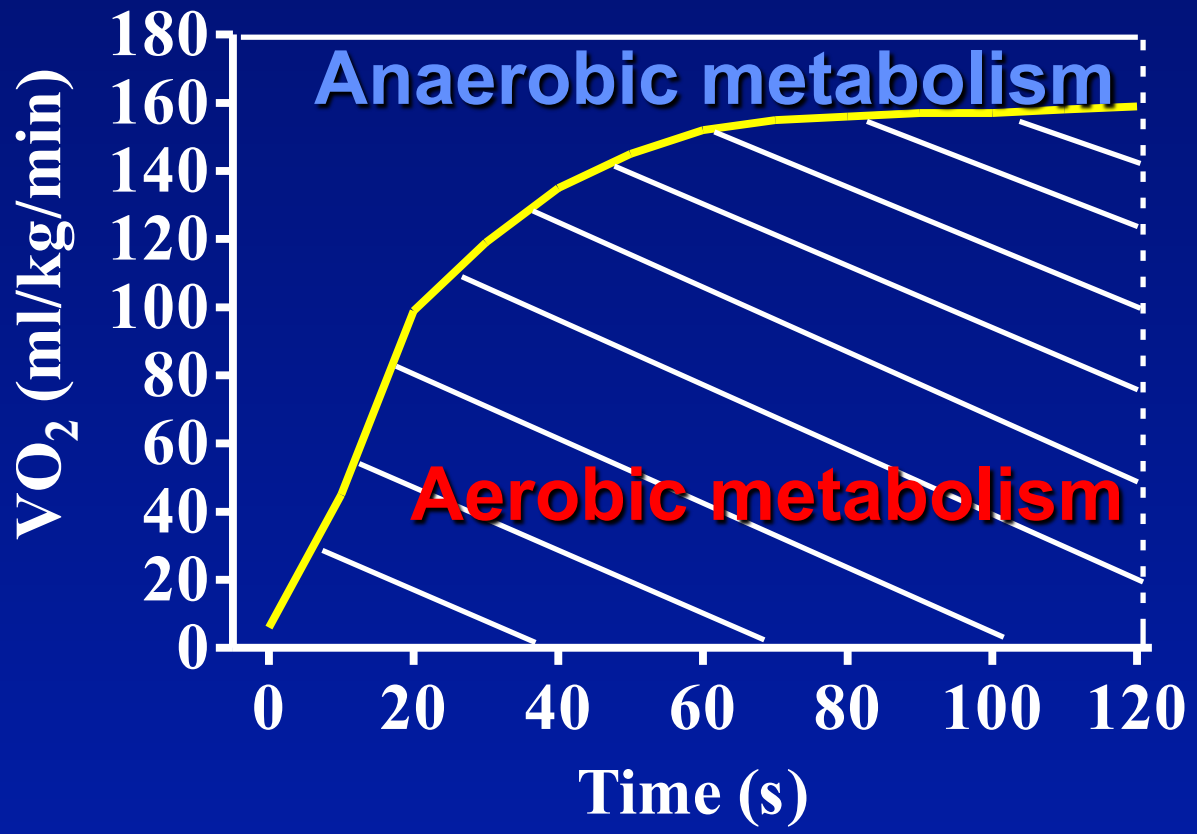
Muscle layer

Anatomy: Alveoli



- Small bronchioles terminate in alveoli (air sacs)
- Rich capillary network around each air sac
- Huge surface for gas exchange

Exercise Metabolism



TOTAL ENERGY

Lung Function: Exercise

- Meet increased demand for oxygen by
  - 6-7 fold increase in respiratory rate
  - 2-3 fold increase in volume of air per breath
- Impairment to gas exchange will decrease performance

Lower Respiratory Disease

- Important cause of "wastage" and poor exercise performance
- Australian study
  - 20% of 2 yr old racehorses had training interrupted by cough or nasal discharge
  - Bailey 1998

Lower Airway Disease

Common Clinical Signs

- nasal discharge
- coughing
- no fever
- decline in exercise performance
  - racehorses - finish races poorly

Lower Airway Disease

Causes: *"The Virus"*

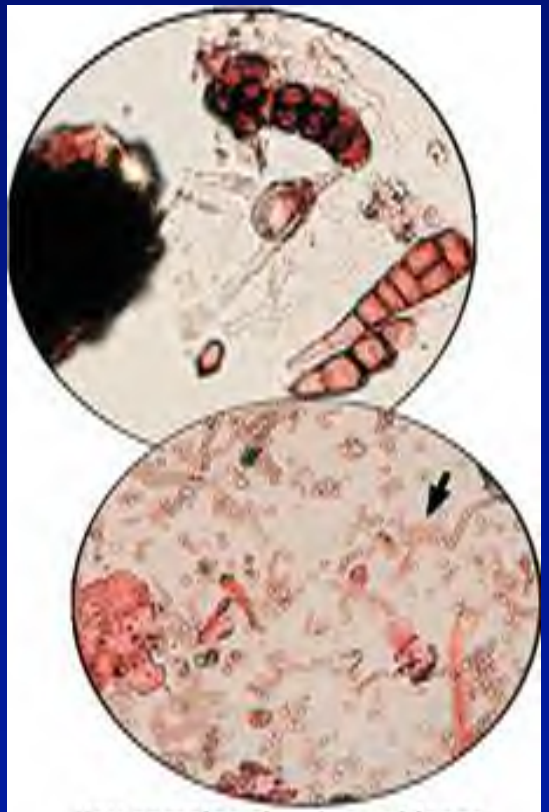
- Age-old explanation for this clinical syndrome
- Does it exist?
  - Recent studies in Australia and the UK indicate that viral infections are an uncommon cause of respiratory disease (racehorse studies)

Lower Airway Disease

- Increasing evidence for role of environmental factors
  - inhaled dusts from feed and stable bedding
  - pollutants e.g. ammonia
  - other allergens
- Direct irritation of the lower airways or triggering of allergic inflammatory response
- New term: ***Inflammatory Airway Disease***

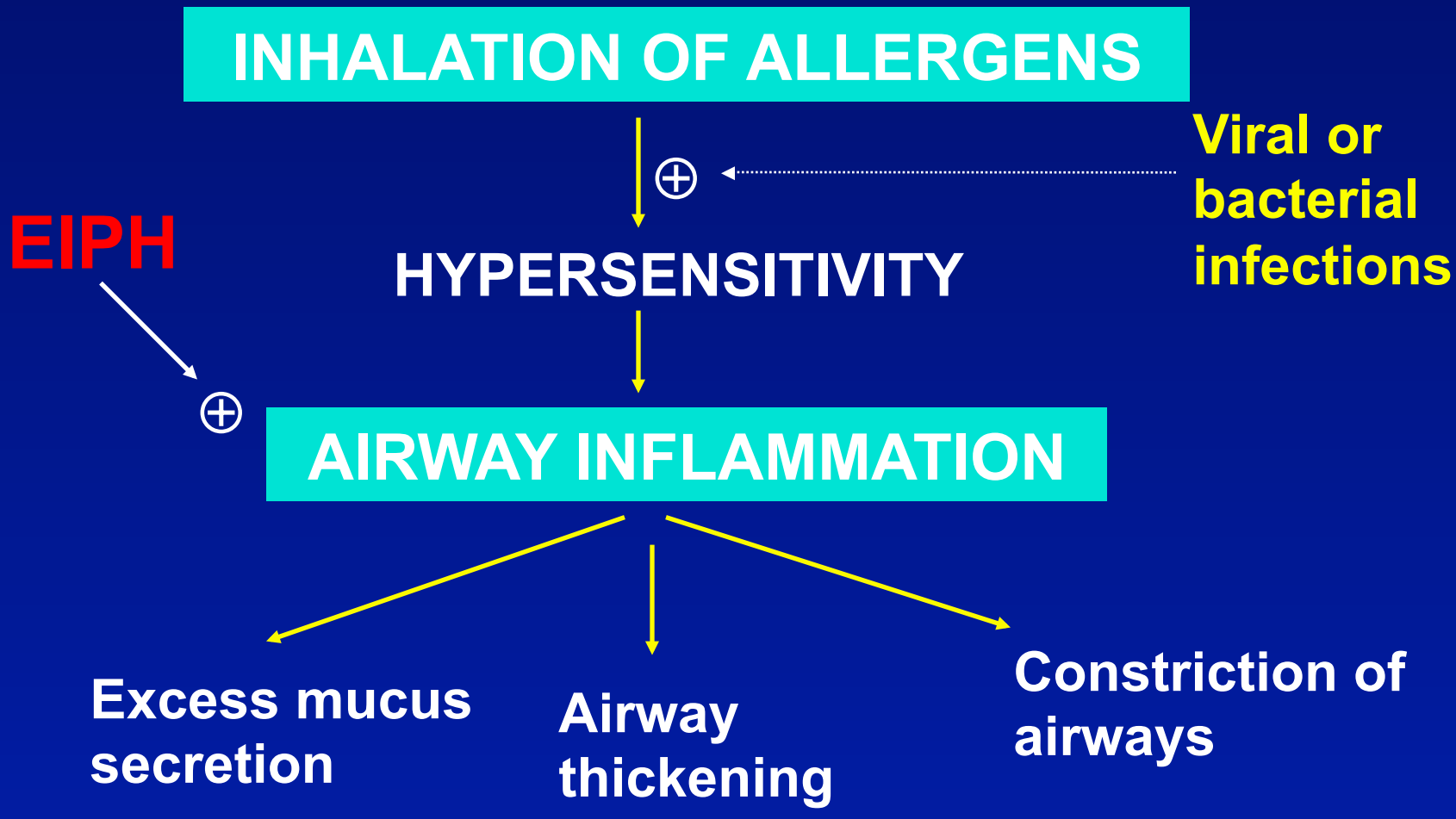
Respiratory Irritants

- Dust generated from mouldy hay and straw contains large numbers of potential allergens
  - fungal and actinomycete spores
  - spores deposit in small airways
- Moisture content at the time of baling is critical

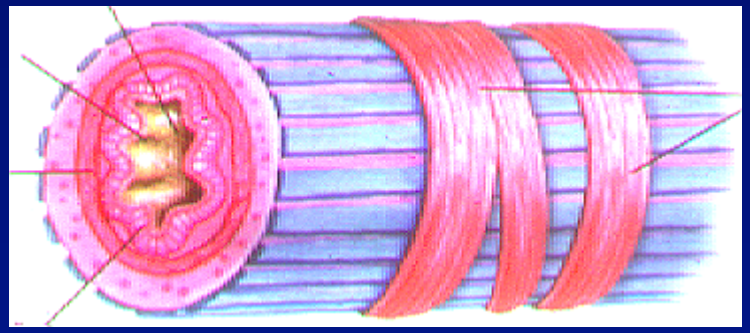


Hay samples showing evidence of heavy mould contamination.

Inflammatory Airway Disease

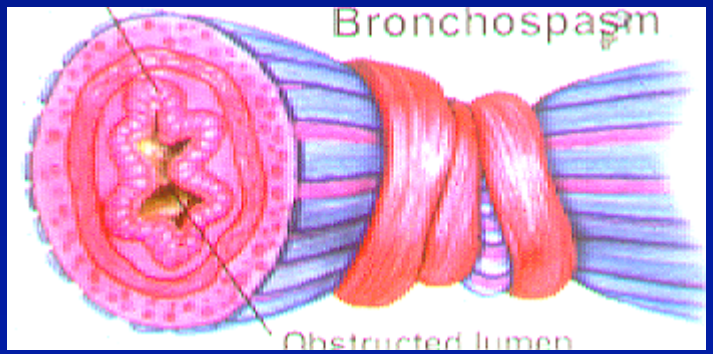


Inflammatory Airway Disease



NORMAL AIRWAY

INFLAMMED AIRWAY



Bronchospasm

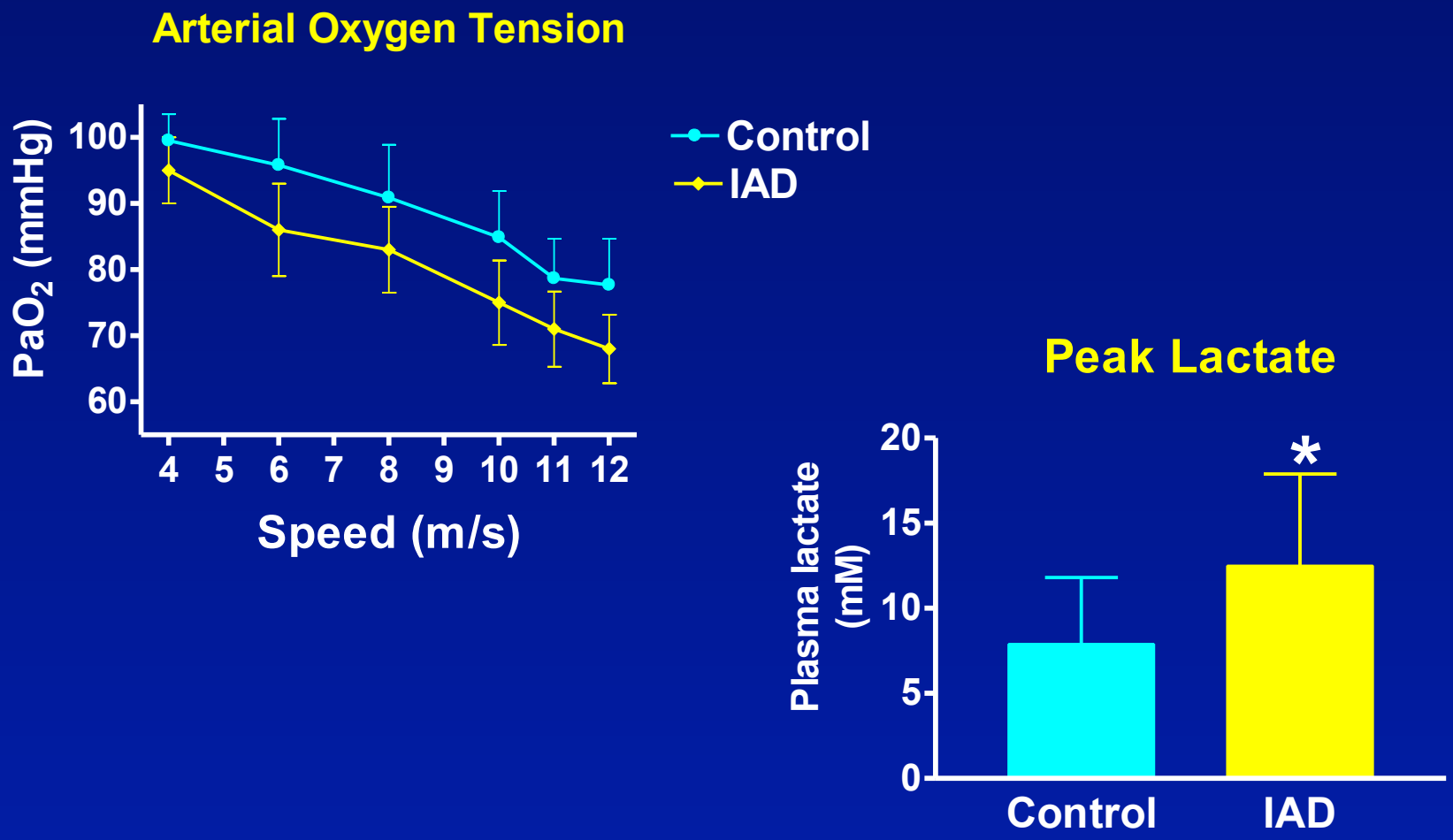
Airway obstruction

Inflammatory Airway Disease

Clinical Exercise Testing

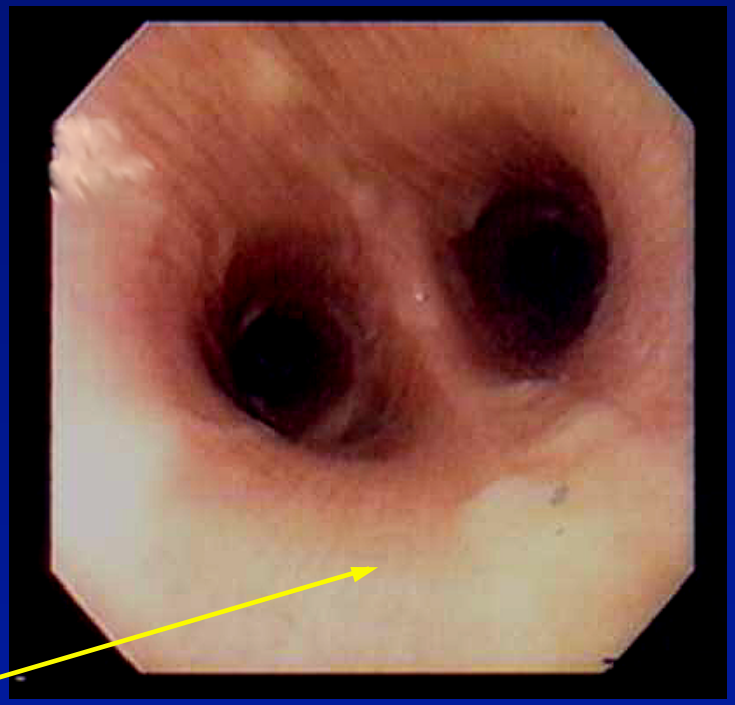
- 15 horses (Tb, Stb) with IAD
  - recent decline in race performance
  - excess mucus in trachea post-exercise
  - abnormal bronchoalveolar lavage cytology
- 10 control horses
  - no history of poor performance
  - normal respiratory examination

Inflammatory Airway Disease



IAD - Diagnosis

- History
  - Poor performance may be only presenting complaint
- Endoscopy
  - post-exercise
  - *mucopus* in the trachea



IAD - Management

- Main aims
  - relieve airway obstruction
  - control inflammation
- Combined approach
  - environmental control
  - drug treatments
    - anti-inflammatory agents
    - bronchodilator drugs

Environmental Control

- The MOST effective method for alleviation of clinical signs of inflammatory airway disease
- Keep horses outdoors as much as possible
- Hygiene of diet and bedding

Environmental Control

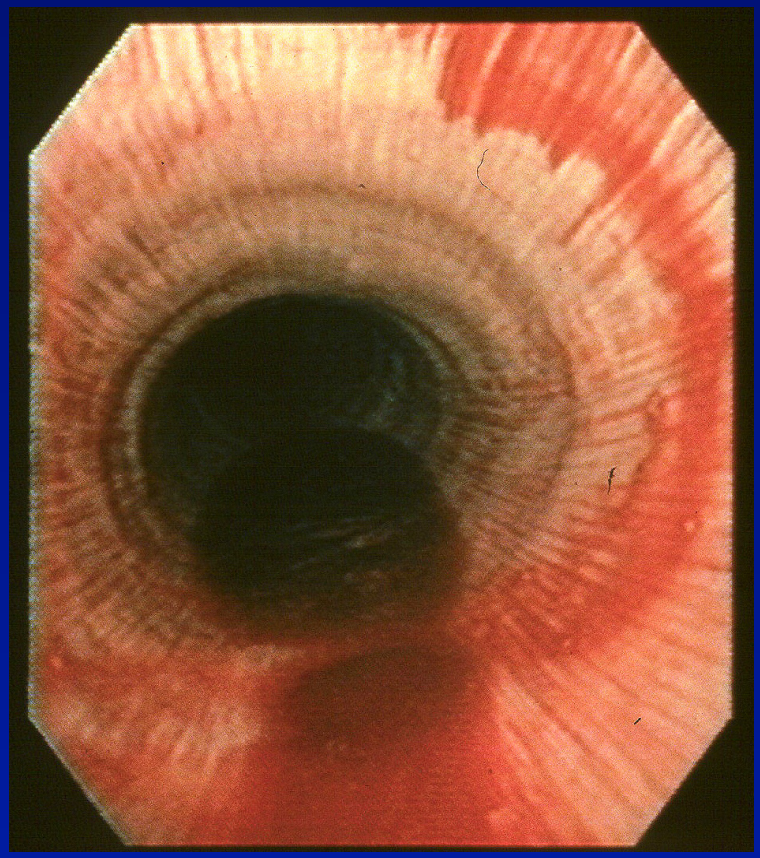
- Removal of *dry* hay from the diet
  - regardless of visual quality of the hay
  - Soak hay prior to feeding
- Alternative forages or feeds
  - hay cubes (wet), haylage, complete feeds
- Bedding material other than straw
  - shredded paper, wood shavings, peat moss, rubber mats

Drug Treatments

- Bronchodilators
  - Short term relief from airway obstruction due to bronchospasm
  - pre-exercise administration
- Anti-inflammatory agents
  - inhaled corticosteroids
- Aerosol drugs
  - therapeutic effect without side effects

Exercise-Induced Pulmonary Haemorrhage (EIPH)

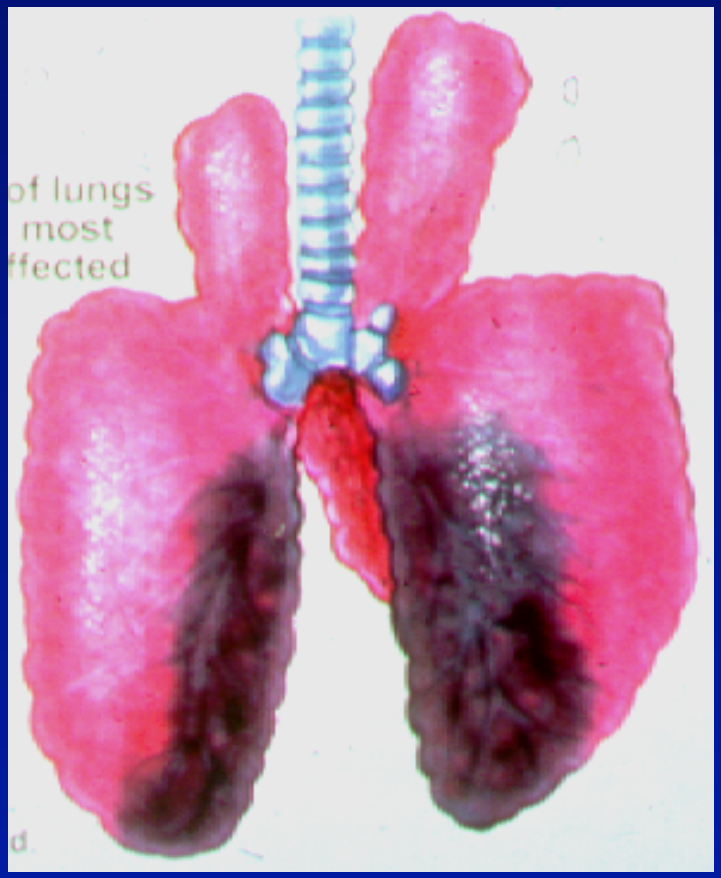
- EIPH - “bleeders”
- Common occurrence in athletic horses
  - endoscopic surveys: >80% of racehorses have blood in trachea post-race
- Possible with other strenuous exercise
  - e.g. eventers



EIPH - Severity

- Bleeders from the nose is quite rare
  - 369 of 250,000 race starts = 0.15% (Japan study: 1992-1997)
  - more likely in older horses, after short races
- Minor bleeding (e.g. visible in trachea) is most common

What causes EIPH?



- Very high pressures across lung tissue-blood vessel interface causes physical tearing
- Caudodorsal area of lung
- Lung scarring with repeated episodes
  - increased severity of bleeds over time

Does EIPH Affect Performance?

- True effect on performance is unknown
- Severe bleeding could impair gas exchange and decrease exercise capacity
- Blood in the airways causes inflammation
  - contribute to development of IAD?

Is EIPH Preventable?

- EIPH is a physiologic phenomenon related to the intensity of exertion
- North America
  - furosemide, a potent diuretic, is administered pre-race
  - enhances performance independent of effect on EIPH?

New Approach to EIPH

Equine Nasal Strips

- Designed to support airways that may “collapse” during exercise
  - lower resistance to airflow
  - decrease the work of breathing

Research Study

To determine the effects of the FLAIR™ equine nasal strip and furosemide, alone and in combination, on EIPH in Thoroughbred horses

Experimental design

- 8 Thoroughbred horses in race training
- Treatments
  - Control
  - FLAIR™ nasal strip
  - Furosemide (0.5 mg/kg IV, 4 hr pre-exercise)
  - Furosemide and FLAIR™ nasal strip

Experimental protocol

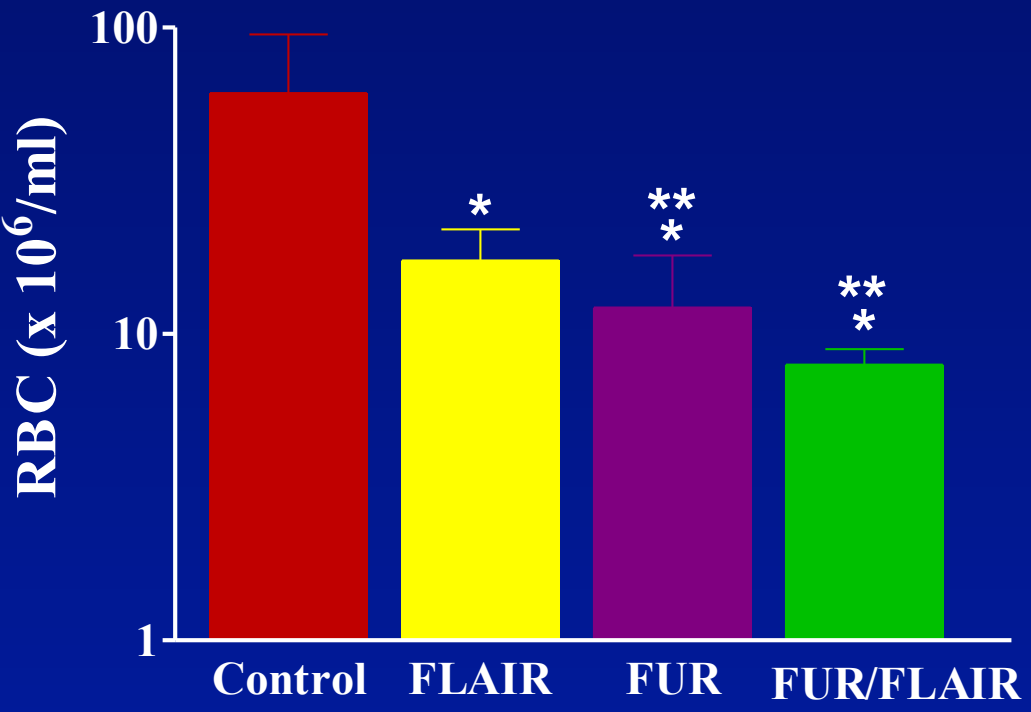
Exercise test

- Treadmill at 3^{o} incline
- 5-min warm-up at ~50% VO_{2max}
- 2-min sprint at speed equivalent to ~115% VO_{2max} (14.2 ± 0.2 m/s)

Bronchoalveolar Lavage

- 30 min post-exercise
  - endoscopic examination of trachea
  - bronchoalveolar lavage (BAL)
- Counted number of red blood cells in BAL fluid

Red Cell Numbers in BAL Fluid



- Shows a significant difference between the Control and Flair
- No significant difference between FLAIR and Furosemide (Lasix) or combination of both.

* P<0.05 vs. Con

** P<0.05 vs. FLAIR

Summary

- Non-infectious lower airway disease is common in athletic horses
- Inhalation of organic dusts and other irritants contributes to development of airway inflammation
- Obstruction of small airways can result in poor exercise performance

Summary

- Repeated episodes of EIPH can worsen airway inflammation
  - role of nasal strips in long term management
- Regardless of cause, treatment of horses with chronic airway problems involves
  - environmental control
  - drug therapy to alleviate airway obstruction and inflammation