Bovine High Mountain Disease

Applied Reproductive Strategies in Beef Cattle

Colorado State University
2008

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Bovine High Mountain Disease (BHMD)
Pathophysiology

BHMD

- Hypoxia
- Pulmonary Vasoconstriction
- Pulmonary Remodeling
- Pulmonary Hypertension
- Right Ventricular Hypertrophy
- Right Ventricular Dilation
- Right Heart Congestive Failure
Hypertrophy of Pulmonary Artery Smooth Muscle

- Normal Pulmonary Artery Smooth Muscle
  PAP-40 mmHg

- Hypoxic exposure
  Hypertrophy of Pulmonary Artery Smooth Muscle
  PAP-80 mmHg
40 mmHg PAP
(Normal)
Pulmonary Vasculature

80 mmHg PAP
(Vasoconstriction)
Pulmonary Hypertension
PA Pressure and Vascular Volume in Resistant and Susceptible Lowland Cattle Transported to High Altitude
Jugular Distension
Necropsy findings
Treatment

- Diuretics
- Antibiotics
- Warming environment
- Limited water and salt intake
- Thoracocentesis
- TLC - supportive care
- Move to lower elevation
- Other ????
Confounding Factors

- **Viral Respiratory Disease**
  - IBR, BVD, PI-3, BRSV

- **Bacterial Respiratory Disease**
  - Mannheimia, Pasteurella, Mycoplasma, Haemophilus, E.Coli

- **Parasites**
  - Migrating GI larva and lung worm

- **Chronic Cold Temperatures**

- **COPD, Asthma (fog Fever)**

- **Chronic Illness**
Confounding Factors continued

- Metastatic Pneumonia
  - Liver abscesses
  - Vena Caval Syndrome
- Traumatic Reticuloperitonitis/Pleuritis
- Lung Abscesses
- Plant Toxins
- Genetics
Why PAP Test?

- Economic Impact!!
- Predict BHMD risk
- Cull animals at risk to reduce herd economic impact
- Selective breeding (heritable)
- Pathophysiology and potential therapies
PAP Testing Rocks?

- IT’S FUN
- IT’S EXCITING
- IT’S NOT WITHOUT RISK AND COMPLICATIONS
- INVASIVE
- ENVIROMENTAL STRESSES
- RELIENT ON ALTITUDE
- AI SIRES
Economic Impact
(> 6500 ft)

- Calf loss due to altitude exposure
  - 5% ➔ Average Annual Calf Death
  - 3 - 35% ➔ Range

- Potential Losses
  - $960.00 = 800 pound yearling
  - 300 head herd
  - 3 - 35%
  - 9 - 105 head
  - $8,640 - $100,800 per year
Example Herd 2/6/05

- 214 Black Angus pregnant cows purchased from Nebraska, moved to San Luis Valley elevation 8000 feet

- Arrived at ranch 01/06/05: as of 2/6/05
  - 6 died from BHMD
    - Total Loss $20,400
  - Culls due to PAP scores
    - 7 cows culled
      - PAP measurements >100
      - with cardiac murmur
    - Total Loss $17,500

Total Loss to Ranch from BHMD = $37,400 within 30 days of arrival to altitude
Decision Making Time
To cull or not to cull . . .

- High risk BHMD animals
  - 32% (n = 68)
  - PAP = 48 mmHg PAP

- Total Value
  - $171,000

NOW WHAT?
Jugular distension
Red Angus Calf
27% Death loss in one year
(117 / 435 > $100,000.00)
PAP Testing Adventures

- 1980 in Gunnison/Hesperus Colorado
- 1980-Present, >193,000 head
- Ambient Temps -42 degrees to 103 degrees.
- Numerous Breeds with high Pap's in all
- Elevations from 800-12,700 feet (14,000 feet)
PAP Measurement Evaluation

- **Altitudes >6400 ft**
- **30-35mmHg**
  - Low Risk score and highly reliable and repeatable.
- **36-39mmHg**
  - Low risk score if animal is >12 months of age, reliable and repeatable.
- **40-41mmHg**
  - Low to moderate risk if animal is >12 months of age but retesting is recommended.
PAP Measurement Evaluation

- **42-45mmHg**
  - Acceptable but moderate risk for animals <12 months of age, acceptable score for animals >16 months of age.

- **45-48mmHg**
  - Moderate to high risk area, retesting advised up to 24 months of age

- **>49mmHg**
  - High risk area for any age and any elevation, poor repeatability, rare false high readings
Risk Factors

- Youth
- Altitude
- Viral, bacterial or parasitic illness
- Body Condition (over or under conditioning)
- Breed
- Gender
- Nutrition (ionophores?)
Age Effects

- **<10 months**
  - Unpredictable
  - Used as screening only

- **≥18 months of age**
  - Stable and Reliable

- **Most accurate**
  - Age >12 months
  - Elevations >6500 feet
Altitude Effects

- <5000 feet
  - Screening only
  - Sitz Angus
- 1-1.5 mmHg increase per 1000 feet elevation rise.
Concurrent Illness

- Any respiratory disease will increase PAP measurement.
- Parasitic influence
  - Lung and Intestinal
Environmental Conditions
Plant Toxins

- Locoweed
  - Swainsonine
  - Indolizide Alkaloid
  - Inhibits the enzyme alpha-mannosidase
  - Oligosacharide storage disease
Body Condition

- Excessive body condition increases PAP
  - Bulls on Test
  - Feedlot Cattle
Breed

- Found in All Breeds
Gender

- No difference Male vs. Female
- Recent change
- Steers and cross breeds lower
Heritability

- DNA and RNA studies
- Autosomal dominant
- Variable Penetrance
- Predictable
- Natural Culling

Common questions

- “If cattle are born and raised at high altitude, are they resistant?
- If cattle have lived there for years how can they be carriers or of any concern?
Heritability

PAP = 113

PAP = 83
Bull #94

- PAP of 83mmHg
- Clinical signs of HMD
- Purchase Price = $9700.00
- Current Value = $600.00
  - if he makes it to the sale and is not condemned
- No bred cows (a good thing ??)
Bull #5

- Full Brother
- PAP 113 mmHg
- Non-clinical at this time.
  - Paid $9000.00 for him
  - Worth $900.00 at sale
  - Use as breeding bull?
  - Prognosis?
  - Heritability? Calf loss……
  - Sale to lower altitude?
Pedigree
Clinical Progression
# Sire Evaluation Data

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<th>SIRE</th>
<th>PAP</th>
<th>ELEVATION</th>
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| Mean       | 43.17|
| Standard Deviation | 6.70 |
## Sire Summaries

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ALTERNATIVES TO PAP TESTING

why
DNA Identification

Genetics

Basis of Hypoxic Pulmonary Hypertension:

“The Brisket Gene”
Questions
Thank You !!