Bovine Leukemia Virus

History

- Clinical disease recognized in 1870’s
- Viral etiology established in 1969
- Experimental transfer of disease with lymphocytes from infect animal in 1972
- Recognition of virus as type C oncornavirus in 1972
- Serology test introduced in 1979
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Bovine Leukosis

**Enzootic**
- Asymptomatic
- Persistent
  - Lymphocytosis
- Lymphosarcoma

**Sporadic**
- Calf form
- Thymic form
- Skin form
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**BLV Clinical States**

- Lymphadenopathy (rectal)
- Exophthalmos
- Diffusely thickened uterus
- Melena (ulcers, esp mid lactation)
- Congestive heart failure - brisket and ventral edema
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**BLV Clinical States - con’t**
- Ataxia, paresis, downer cows
- Emaciation
- Edema / swelling of extremities
- Sudden death - splenic rupture
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**Prevalence**

- Worldwide distribution
  - Prevalence rates vary dramatically with country
- Prevalence increases with age
- Dairy cattle generally have higher prevalence rates than beef cattle
  - Management factors
  - Breed susceptibility differences?
BLV Prevalence Estimates:
U.S. Dairy Cattle

% AGID Positive

Year

1975 1988 1997

NAHMS
BLV Prevalence by Age Group

Johnson & Kaneene 1998
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**:Bovine Retroviruses**

- **Oncornavirus** - Bovine leukemia virus - BLV
- **Spumavirus** - Bovine syncytial virus - BSV
- **Lentivirus** - Bovine lentivirus - BIV
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gp60/51 - major envelope glycoprotein

gp30 - transmembrane protein

p12 - matrix protein

p24 - capsid protein

p12 - nucleic acid binding protein

p151/10 - phosphorylated nucleic acid binding protein
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- Retrovirus
  - Proviral DNA integrates into the chromosome of host cell
    - Infection persists for life of cell or animal
    - Virus generally evades immune surveillance system
    - May assume control of cell division
    - Can exist in absence of viremia
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 Detection of Infected Animals

 - Leukosis “keys”
 - Serology tests
   - Agar-gel immunodiffusion
   - Enzyme immunoassays
   - Radioimmunoassays
   - Virus neutralization
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- Detection of Infected Animals-con’t
  - Virus neutralization
  - Antigen detection tests
    - Plasma Blocking Factor
  - Nucleic Acid detection tests
    - DNA probes
    - Polymerase Chain Reaction
Retroviral Transmission

Vertical

Endogenous virus

Horizontal

Exogenous virus
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Vertical Transmission

- No evidence for the transmission of BLV through semen or through embryos from BLV-positive animals
- In utero infection of the fetus does occur with variable frequency
  - Status of dam is critical factor
BLV+ calves born to all sero+ dams:

\[
\frac{23}{208} = 11\%; \quad 95\% \text{ CI: } 7-16\%
\]
BLV+ calves born to all sero+, Non-PL dams:

13/189 = 6.9%; 95% CI: 4-11%
BLV+ calves born to PL dams:

10/19 = 53%; 95% CI: 30-75%
Persistent Lymphocytosis

1. Absolute Lymphocyte count greater than three SD above the mean

2. Breed and Age Specific

3. Minimum Duration- 3 months
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- Poor transmittors
  - Transmittors
- +Gp51
- -P 24
- Normal lymphocyte count

Efficient

- +Gp51
- + P24
- +Lymphocytosis
How does BLV spread?

- Transfer of blood or other body fluids with blood cells to uninfected animals
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Horizontal Transmission

General

- Viremia is non-existent or extremely transient
- BLV infectivity is associated with the transfer of blood cells
- Incidence of transmission is not constant

- Widely held belief that young calves are more susceptible to infection
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- Horizontal Transmission con’t
- Direct Contact
  - In absence of viremia, physical proximity of infected and uninfected animals may be low risk
  - Most studies fail to take into account the “range” of infectivity of BLV-positive animals
  - Animals with lymphosarcoma and animals persistently lymphocytotic are more likely to transfer the disease
  - Close contact does increase likelihood of transmission
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- Horizontal Transmission-con’t
  - Iatrogenic
    - Multiple use of single needle
    - Frequency of vaccination increases risk
    - Multiple use of obstetric sleeves
    - Contaminated vaccines
    - Dehorning instruments
    - Tattooing instruments
How does BLV spread?

**Equipment:**

- Needles
- Syringes
- Obstetrical sleeves
- Dehorners
- Tatoo pliers
- Ear taggers
- Medicine vials (oxytocin)
- Hoof knives
- Nose tongs
- Rectal ultrasound equipment
- Tail docking equipment
- Ear notchers
- Milking equipment
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**Horizontal Transmission con’t**

- **Insects**
  - Larger insects more likely to transmit
  - No evidence for biological vector
  - Increased incidence rates in summer and fall
  - Higher prevalence in warmer climates
  - Higher prevalence in wetter areas
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Horizontal Transmission-con’t

Milk

- BLV infected lymphocytes exist in milk and colostrum from BLV-positive animals
- Bulk tank milk fed to BLV-negative calves will transmit the disease
- Feeding colostrum from BLV-positive animals is still controversial
  - May be protective under certain conditions
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Direct Losses

- Condemnation at slaughter
- Higher culling rates
- Decreased reproductive performance
- Decreased milk yields

Most all economic analyses have failed to distinguish various clinical entities of BLV
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Indirect Losses

- Loss of export market
- Loss of sales to AI industry
- Loss of sales to embryo transfer industry
- Loss of consumer confidence
- Expenses involved in status testing
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Zoonotic Potential

- BLV will infect human cells
- No study has linked BLV to human disease
  - Most not willing to deny potential exists
  - Molecular technology should be able to provide definitive answer
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Control Options

- Test and Slaughter
- Test and Segregate
- Test with Management Changes
Controlling Spread of BLV

- Critical to prevent the horizontal transmission of white blood cells from infected to uninfected animals
  - Clean maternity pen, remove calf ASAP
  - Feed colostrum from negative cows
  - If prevalence in herd is high (over 60%) freeze colostrum to destroy virus
  - Do not feed waste milk
  - Manage positive and negative groups separately
Controlling spread…cont.

- Use single-use needles
  - Discard syringes with blood contamination
  - Prevent blood contamination of medicine/vaccine vials
- Clean and disinfect equipment used between animals
- Use electric dehorners rather than cutting dehorner
- Use new OB sleeve for each cow
- Use artificial insemination
Controlling spread…cont.

- Do not over crowd animals
  - No greater than 110% in freestalls
- Implement an integrated pest management program
Is testing necessary?

Testing can be helpful

- Determine which animals are infected
- Monitor progress for control or eradication
- Determine if and where horizontal transmission is occurring in herd
Timeframe to Eradication

Dependent upon:

- Initial herd prevalence
  - Higher prevalence = longer time to eradication
  - Very high prevalence (60-80%) may not be able to accomplish without separation of negative and positive groups

- Level of commitment
  - Need to implement ALL management practices

- Ability to raise only BLV negative heifers
  - Break cycle of new infections
Timeframe to Eradication

Dependent upon:

- Degree of crowding and possibility of animal-to-animal contact
  - Horizontal transmission - nasal/ocular discharge
- Feasibility of separating negative and positive groups
- Priority given to culling BLV positive animals
- Frequency of testing
  - Herd testing (6 months and older) every 6 months
  - Identify groups with new infections
  - Confirmation of negatives