Bovine Leukemia Virus

FRANCESCA VENTURI
LCS 630
Prevalence

- Worldwide distribution
- 88.5% dairy herds (43% of dairy cows)
- 38.7% of beef herds (10.3% beef cows)
- All breeds susceptible
- Cattle >2 years are more susceptible
- Infected herds may have up to 80% seropositive
surgical instruments eg, dehorning gouges, ear tattooing pliers, and hypodermic needles.
Risk Factors

- **Animal**
  - Genetics found to play a role in resistance vs. susceptibility to development of persistent lymphocytosis +/- lymphosarcoma

- **Environmental and management**
  - Inadequate biosecurity
  - Poor calf management
Pathogenesis

- C-type oncovirus in the family Retroviridae
- Establishes persistent infection in a subpopulation of B-lymphocytes
  - Incorporates proviral DNA into host cell DNA
- Host is infected for life!
- Infection with BLV does not actually mean that animal will develop clinical signs and malignant neoplasia
  - Majority of animals do not develop persistent lymphocytosis and/or lymphosarcoma
  - <5% will go on to develop malignant neoplasia

Possible outcomes after exposure to BLV

Exposure

Infection

No infection if animal genetically resistant

Seroconversion

Persistent infection. Seropositive. No lymphocytosis, no tumors because of genetic resistance

Lymphosarcoma tumors develop Malignant neoplasia (<5%)

Persistent lymphocytosis benign proliferative state (29%)
Enzootic Bovine Leukosis (Lymphosarcoma)

- Most common neoplastic disease of cattle
- Typically affects adult cattle >2 years of age
- <5% of cows infected with BLV advance to this malignant stage
- Incubation period is 4-5 years following BLV infection
- +/- prior development of persistent lymphocytosis
- At this stage, BLV infection has progressed to full blown lymphosarcoma
- Tumors develop rapidly in multiple organ systems
Enzootic Bovine Leukosis (Lymphosarcoma)

- **Great variation in clinical signs and syndromes**
  - Peracute: 5-10% of clinical cases have sudden death without prior clinical signs
    - Usually due to adrenal gland involvement, rupture of abomasal ulcer or spleen followed by massive GI hemorrhage
  - Subacute (up to 7 days) to Chronic (several months)
    - Loss of body condition, appetite, pallor, muscular weakness

- **Once clinical signs & tumor development detected → death in 2-3 weeks**
Diagnosis

- Clinical Signs - related to sites of tumor deposition
  - Weight loss
  - Drop in milk production
  - Enlarged lymph nodes
  - Anorexia
  - Paralysis in the hind limbs
  - Gastrointestinal obstructions
  - Exophthalmos
  - Cardiovascular compromise

- Hemogram
  - Often unremarkable
  - Some will develop persistent lymphocytosis prior to progression to malignancy
  - Anemia may be present in cases of acute hemorrhage

- Lymph node aspirates
  - Often difficult to differentiate between lymphosarcoma and lymph node responding to infection

Lesions

- Young cattle
  - Kidneys
  - Thymus
  - Liver
  - Spleen
  - Peripheral and internal lymph nodes

- Adult cattle
  - Peripheral lymph node enlargement
    - Often accompanied by subcutaneous lesions
  - Heart
    - Particularly right atrium
  - Abomasum
    - Ulceration, thickening, tumors present in mucosa
  - Spinal cord
    - Thickening of peripheral nerves
Clinical Pathology

Lymph node aspirate from cow with lymphosarcoma (homogenous cell population of lymphoblasts)

Large buffy coat within hematocrit tube after centrifugation from a cow with acute lymphoblastic leukemia (WBC 290,000/μl)


Testing

- **Diagnosis of BLV infection**
  - **AGID test**
    - Good screening test to determine individual or herd infection status
    - May not detect presence of virus until 2 months post infection
  - **ELISA test**
    - Has replaced AGID in some countries
    - More sensitive than other serological tests
    - Can be used on serum or milk
- **Detection of virus**
  - **PCR**
    - More sensitive than AGID or ELISA when prevalence of infected herd is <5%
    - Useful for early detection of BLV before antibodies are present
    - Can differentiate uninfected newborns with colostral antibodies from BLV infected calves

Differentials

- **Sporadic bovine leukemia** *(discussed on the following slide)*
  - Lymphoma like symptoms, usually in young cattle (*<3 yrs of age)*
- **Congestive heart failure (traumatic pericarditis)**
  - If BLV associated cardiac lesions are present
  - In BLV, fever and toxemia are typically absent
- **Johne’s disease**
  - If GI manifestations are present (diarrhea)
- **Lymphadenitis**
  - Tuberculosis and actinobacillosis
- **Compression of spinal cord**
  - Abscess, rabies (usually much shorter clinical course)
- **Fat necrosis**
  - Multiple abdominal lymphadenopathy and nodular lesions in uterine wall

Sporadic Bovine Leukosis

- Unknown etiology
- Cattle <3 yrs of age
- B-cell or T-cell lineage (enzootic BLV only affects B-cells)
- 3 main manifestations
  - Juvenile form
  - Thymic form
  - Cutaneous form
- Seronegative for BLV (not associated with BLV infection)
- Non-contagious, non-transmissable, usually isolated cases

Sporadic Bovine Leukosis, cont.

- **Juvenile form**
  - Calves <6 months old
  - Multiple lymph node enlargement
  - Death in 2-8 weeks following onset of clinical signs

- **Thymic form**
  - Yearlings <2 yrs old
  - Swelling in the neck and subsequent bloat & edema
  - Death in 2-8 weeks following onset of clinical signs

- **Cutaneous form**
  - Cattle 1-3 yrs old
  - Development of nodes and plaques in the skin with necrotic centers
  - Regression possible

BLV Treatment

- NONE
- No effective vaccines have been developed
- Supportive care

Reference:
Economic Impact of Enzootic BLV

- Decreased milk production
- Decreased fertility
- Costly to treat and diagnose
- Replacement costs of cattle dying or culled
- Failure to retain salvage value of condemned cow at slaughter
  - If lymphosarcoma is diagnosed at slaughter carcass is automatically condemned
- Trade restrictions on import of BLV positive cattle and semen

BLV: Control, Eradication, Prevention

- **Recommended protocol for complete eradication**
  - Identify infected animals with AGID
  - Cull and slaughter seropositive
  - Retest herd 30-60 days later
  - PCR test for young calves

- **Preventing BLV from entering herd**
  - Test all incoming and returning cattle
  - Segregate and retest in 45-60 days
  - Manage as positive until BLV status is determined
BLV: Control, Eradication, Prevention

- Many nationwide eradication programs present in Europe
  - Successful due to low prevalence of infection and minor economic losses from culling seropositive cows
- Voluntary eradication programs present in USA and Canada
  - Culling of all seropositive cattle would be cost prohibitive due to widespread nature of disease in these countries
  - Aimed at prevention of spread

## BLV: Control, Eradication, Prevention

**NY State BLV Eradication & Certification Program Guidelines**

- Single use sterile needles
- One disposable obstetric sleeve per cow
- Electric dehorner over gauge/saw (less hemorrhage and easier to sanitize)
- Insect vector control program
- Use AI
- Early separation of calves from infected dams and segregation of individual calves
- If prevalence is >60% in the herd, freeze colostrum before use to destroy virus

References


