

Cause for Concern: Bovine Leukemia Virus

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Bovine Leukosis – Where have we been?

Bovine leukosis (leukemia) virus infection has been monitored in the United States cattle population since the late 1970's when a serologic test was first introduced (14). Prior to that time there was sporadic clinical evidence dating back to the late 1800's that cattle were susceptible to infectious cancer (13). The agent was first identified in 1969, and that discovery allowed for development of various diagnostic tests. Over the past 40 years testing has allowed us to monitor for BLV infection from its subclinical phase to the clinical phase, and construct reliable control strategies for BLV infection in herds, regions, and in some cases, complete eradication (12).



Initially, there were two reasons to control BLV. They were first centered on reduction of carcass condemnation at meat processing plants, and the second was to improve trade-marketing of cattle within regions and between countries. Since overt clinical forms of bovine leukosis were being noticed less due to cows shorter duration of time on the farm (primarily dairy cattle), trade restrictions between countries were the predominant reasons to test for and certify populations of cattle as “BLV free” (16).

Recently, there has been renewed interest in controlling BLV within the United States not only for improvement of trade-marketing of cattle, but also because of newer data, which affirms that BLV infection has a negative effect on dairy cattle production (1, 6). These data, in addition to reports of BLV genomic segments being found in human tissues have prompted this update (5, 10).

Bovine Leukosis – Why test for it?

The question really should be, why not test for it? The test using serum has very good sensitivity (98%) and specificity (100%) and, although not licensed by USDA, the test for milk has good sensitivity (95%) and specificity (99%). In repeated studies over the past ten years, it has been demonstrated that BLV infection is not just subclinical, but that there are demonstrable clinical effects and production losses associated with infection (2, 3, 6).

Several recent reports indicate that BLV infection reduces milk production, increases death losses, and has a negative effect on the dairy industry in general (2, 17). Bartlett et al. reported that BLV-infected animals were more likely to be culled early or die (2). This evidence raises awareness that there is a range of disease manifestations associated with BLV infection in addition to lymphosarcoma. What we used to call subclinical infection is now seen to manifest slowly and is more analogous to a chronic debilitating type of BLV syndrome (3).

While effects of BLV infection on the animal are important, there is increasing laboratory data that demonstrates BLV proviral (viral DNA) sequences within human tissues (5, 10). This observation has been speculative before, but with increasing test sensitivity using molecular diagnostics, the data are more convincing. Authors of these reports indicated that further analysis is required before a direct cause and effect can be determined. However, in the best interest of the dairy industry it would be prudent to move towards a voluntary BLV eradication program over the next few years, the recommendation from Drs. Janice Miller and Martin Van Der Maaten over 30 years ago (15).

What options do we have for controlling BLV infection?

There are at least four options to consider when talking about BLV control (Table 1) (3). The first is that no actions are taken to test for or remove BLV test positive cattle, the primary approach taken in the US. The second would be where the herd is monitored for BLV infection by blood or milk based antibody testing, and that management changes (Table 2) are instituted in an effort to reduce spread of the virus. This practice has been instituted on many farms throughout the country and can be effective in reducing herd prevalence within several years. The third and fourth options are similar, in that initially all cattle are tested, the herd is maintained as closed, and only BLV test negative cattle are added to the herd. The major difference is that in option three, animals are segregated depending on their BLV infection status; in essence, maintaining two subpopulations, one BLV test negative, and one BLV test positive. This option has benefits of a “phase BLV infection out process”, which then leads to option four, which is characterized by culling any BLV test positive cattle and using strict biosecurity on all incoming cattle.

Table 1. Summary of options for BLV control in United States dairies.

(Modified from Bartlett et al, 2014.³)

1. No action taken.
2. Monitor for BLV infection by testing for BLV specific antibodies in serum or milk. Make comprehensive or selected management changes (Table 2) to reduce spread of BLV.
3. Test all cattle and separate out BLV test positive cattle. Make selected management changes to reduce spread of BLV. Maintain a closed herd or only add BLV test negative cattle (two negative tests 30 days apart).
4. Test all cattle and cull BLV test positive cattle. Maintain a closed herd or only add BLV test negative cattle (two negative tests 30 days apart).



Table 2. Recommended management changes to decrease BLV spread within dairy herds.

(Modified from Bartlett et al, 2014.³)

1. Use separate needle for each animal.
2. Clean/disinfect blood-contaminated equipment for tattooing, ear tagging, dehorning, supernumerary teat removal, and other surgical procedures between animals.
3. Use a new or cleaned rectal palpation sleeve for each cow.
4. Use AI exclusively for breeding purposes.
5. Control stable and other biting flies.
6. Segregate BLV test positive cattle from BLV test negative cattle.
7. Cull BLV test positive cattle with lymphocytosis.
8. Minimize contact between newborn calves and BLV test positive cattle.
9. Avoid feeding unpasteurized colostrum from BLV test positive cows to newborn calves.⁴

What management changes can decrease BLV spread within and between herds?

Management changes that result in decreasing BLV infection in a herd are multiple and largely animal age dependent (8, 11, 12). Herds studied in the Northwest showed a stair-step like increase in BLV infection over the lives of the animals (Fig 1) (8). A number of infections occurred in utero, but was quite variable (3-20%), due perhaps to the animal's genetics or the percent of cattle with lymphocytosis during their pregnancy, or both.

The second peak of infection occurred during calfhoo, in which up to 40% of infections took place. This may have been due to feeding

colostrum from BLV-positive cattle, spread of infection by blood contaminated instruments (dehorner, ear tagging pliers, ear tattooers, etc.), or by common-use needles during vaccinations, injectable treatments, etc.

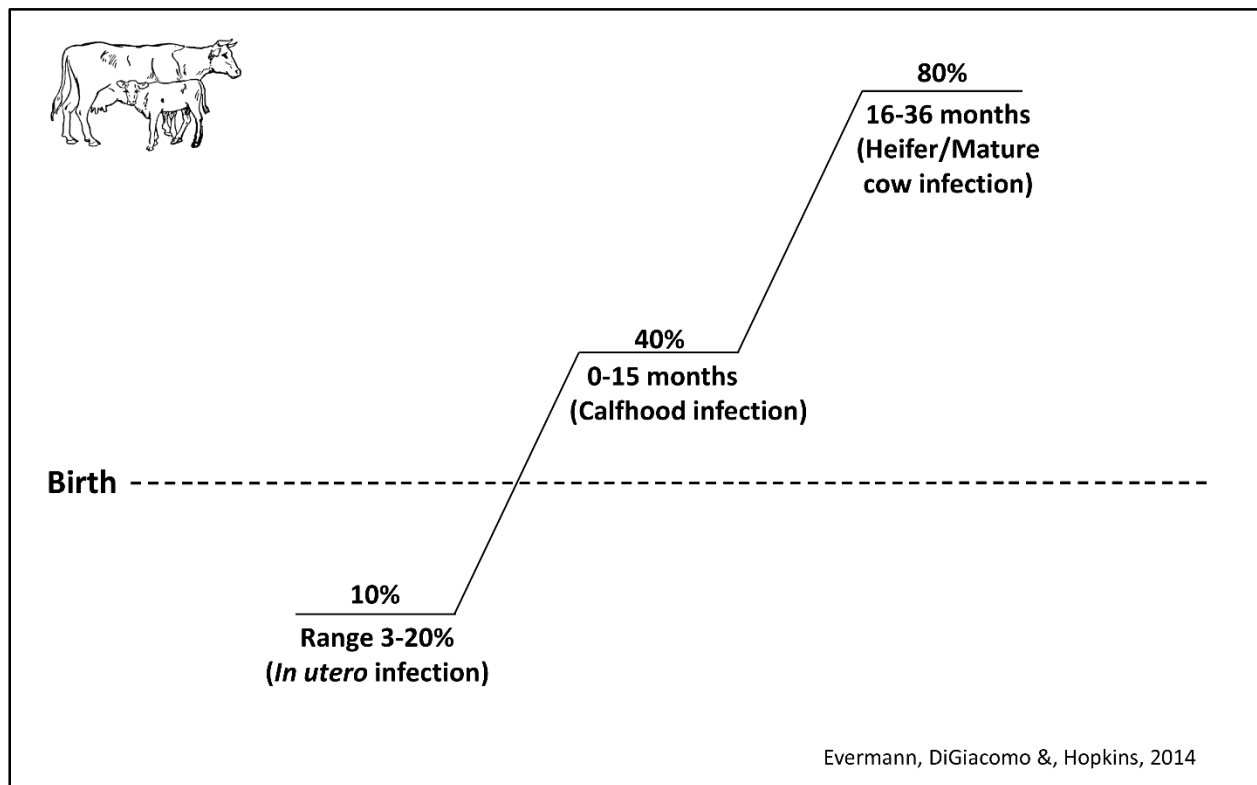


Figure 1. Schematic demonstrating the three age-related risk periods for bovine leukemia virus (BLV) infection (Cumulative percentages*). Modified from Evermann et al, 1987.⁸ *Percentages are independent of herd additions of BLV-infected cattle.

The third peak was noted at the heifer/mature cow ages, and doubled the infection rate in the herd up to 80%. Again, as was noted for calfhood infection, blood contaminated instruments and needles are critical in the spread of the virus. In addition, rectal palpation was considered to be a risk for spread of BLV on some dairies.

What is the risk of spreading BLV infection in the herd?

Another way to look at BLV spread is to categorize what particular management procedures are at higher risk compared to others (11). In Table 3, procedures are divided into thirds: calfhood; reproductive; and housing and confinement. For each category, there is a risk of either high or low assigned to that particular procedure. The common element amongst the high risk procedures is blood, where it has been demonstrated that it only takes a fraction of a drop (0.001 ml) of blood to infect an animal (7).

Table 3. Risk of BLV spread in cattle under production conditions.

(Modified from Hopkins and DiGiacomo, 1997.¹¹)

Risk	Calfhood Procedures	Reproductive Management	Housing/ Confinement
High	Gouge dehorning with a common instrument Other surgical procedures permitting blood transfer Intravenous injection or blood draw with a common needle and/or syringe	Rectal palpation with a common sleeve	Contact with blood, tissues, and fluids at parturition Contact between cattle in herds with high BLV prevalence
Low	Ear tagging Tattooing Subcutaneous, intradermal, or intramuscular injections	Natural breeding Artificial insemination Embryo transfer	Hematophagous insects

What can the laboratory do to assist in screening for BLV infection?

Since the majority of cattle will seroconvert (develop antibodies) far in advance of clinical signs, it is important to test animals at key times in their production cycle (9, 14, 15). Antibody testing is the most common and inexpensive assay. There are PCR assays available, but they are not validated by the USDA, and are generally used to detect varying loads of virus in circulation or body tissues for research.

Serum-based and milk-based ELISA are available nationally and internationally, and are generally regarded as the OIE gold standards (16). Depending on the option(s) used to control BLV infection, testing can be done annually on the resident herd, and on all replacement animals (two negative tests 30 days apart) (3, 7).

The WADDL tests for BLV antibodies on serum samples every Tuesday. The turnaround time is usually 24-48 hours. If any questions arise, please contact the Consulting Microbiologist at 509-335-9696, or Dr. Evermann at 509-339-3607 or jfe@vetmed.wsu.edu.

Refer to the WADDL website for copies of the accession and multiple animal ID forms: www.vetmed.wsu.edu/depts_waddl

Conclusion

New evidence points to the effects that BLV has on cattle health and performance. However, the infection/disease prevalence in the herd can be managed, and in some cases eradicated, with testing and a variety of management changes.

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