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Abstract

Bovine leukosis virus (BLV) is a cancerous condition of tissues in which lymph nodes and lymphocytes are affected. Infected cattle may be identified by testing blood sera for BLV antibodies using the agar gel immunodiffusion (AGID) test that requires 2 days for processing. Most dairy farms have infected animals, but the condition is not considered important because less than 1% of infected cattle show clinical signs. However, many of these cows are culled because of poor milk production or reproductive performance. Procedures for reducing and(or) eliminating the disease are outlined. Results obtained at the Kansas State University Dairy Teaching and Research Center demonstrate that feeding only colostrum and whole milk from BLV-negative cows to newborn and young calves is an effective method of reducing the incidence of BLV in future generations.; Dairy Day, 1996, Kansas State University, Manhattan, KS, 1996;

Keywords

Dairy Day, 1996; Kansas Agricultural Experiment Station contribution; no. 97-115-S; Report of progress (Kansas Agricultural Experiment Station and Cooperative Extension Service); 771; Bovine leukosis; Virus; BLV- free colostrum

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REDUCING BOVINE LEUKOSIS IN DAIRY CATTLE

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Summary

Bovine leukosis virus (BLV) is a cancerous condition of tissues in which lymph nodes and lymphocytes are affected. Infected cattle may be identified by testing blood sera for BLV antibodies using the agar gel immunodiffusion (AGID) test that requires 2 days for processing. Most dairy farms have infected animals, but the condition is not considered important because less than 1% of infected cattle show clinical signs. However, many of these cows are culled because of poor milk production or reproductive performance. Procedures for reducing and(or) eliminating the disease are outlined. Results obtained at the Kansas State University Dairy Teaching and Research Center demonstrate that feeding only colostrum and whole milk from BLV-negative cows to newborn and young calves is an effective method of reducing the incidence of BLV in future generations.

(Key Words: Bovine Leukosis Virus, BLV-Free Colostrum.)

Introduction

Most foreign markets demand bovine leukemia (leukosis)-free heifers, semen, and embryos. Economically, this is a reason for concern, because most dairies in the U.S. have at least some cows that are infected. Isolation of the positive-testing cattle along with implementation of new management techniques, which reduce accidental blood exposure from seropositive to seronegative cattle, will reduce the prevalence.

General Description

Bovine leukosis, bovine leukemia, lymphosarcoma, and malignant lymphoma are

names given to a retrovirus disease in cattle caused by the bovine leukosis virus (BLV). All of these terms refer to a cancerous condition of tissues in which lymph nodes and white blood cells (lymphocytes) are affected. Because lymph nodes to which white blood cells constantly circulate are located throughout the body, the disease may localize in many areas. True leukemias, where the entire body is affected, are rare. Most often, the condition develops in other organs, if not a lymph node, and is not expressed until the animal is an adult. Cattle with the adult or enzootic form of bovine leukemia are usually 4 yr of age or older, but it can occur as early as 2 yr of age. Many of these cows are culled because of poor milk production (over a period of a few days) and, in some instances, may show poor appetites followed by weight loss. Poor appetite may be due to throat tumors that lessen the ability to swallow. Because the signs of the disease vary, many of the cows infected may be identified as having another problem such as hardware disease, abomasal problems, and spinal cord injuries, especially affecting the rear legs. Abortions and infertility also may occur if the uterus or other reproductive organs are involved. An exploratory rectal palpation is the best diagnostic tool to locate internal tumors, if peripheral lymph node enlargement or exophthalmos are not observed. Bovine leukosis virus-infected cattle often are identified by testing sera for BLV antibodies using the agar gel immunodiffusion (AGID) test that requires 2 days to process. Most dairy cows are infected with the virus, but it often remains in a dormant state until the animal is stressed, such as during extremely hot or cold weather, parturition, or illness. BLV-infected cattle show clinical signs less than 1% of the time, but the number of cows being condemned at the slaughter plants is increasing, suggesting

that the number of cows infected is increasing nationally.

Cattle become infected most often after contact with blood from an infected animal. Only .0005 milliliters of blood is needed for the virus to infect a lymphocyte of a healthy animal. Procedures such as injecting, castrating, dehorning, and rectal palpation can spread the virus, as well as blood sucking insects such as horse flies. Balling guns or any instrument that comes in contact with cattle should be sanitized properly after each use. Natural service with a bull also may contribute, because some blood may be transferred during copulation, so artificial insemination is preferred. Calves born to infected dams contract the disease at birth about 5% of the time. Also, any calf fed BLV-positive milk is at a greater risk of contracting the disease. Virus to antibody ratios can be used to determine if a BLV-positive cow will transfer the virus to her calf. Cows exhibiting high virus coupled with low antibody titer tend to transfer the disease to their offspring, whereas cows exhibiting low virus with a high antibody titer tend to transfer immunity to their offspring.

Breeders of registered cattle suffer the biggest economic loss if animals are found positive. Many countries and U.S. companies will not accept animals or animal products infected with the virus. Heifers or semen may be rejected, causing a large monetary loss to the heifer breeder or bull stud owner. Some countries also require dams producing embryos to be seronegative. The economic impact to commercial dairy producers includes reduced performance, treatment and diagnosis costs, on-farm death losses, condemned carcasses, and cost of replacements.

To date, little evidence exists that the disease is transmissible to humans. Pasteurization destroys the virus easily, and at room temperature, outside of living cells, the virus can live for only a few hours. Families that consumed raw milk containing the virus were studied and found to be free of BLV infection. Veterinarians and others who work closely with BLV-positive blood daily have not been infected.

Prevalence in U.S. Dairy Cattle

The National Animal Disease Center reported that the number of cows condemned at slaughter because of lymph node tumors (lymphosarcomas) tripled between 1975 and 1990 and is nine times that found in Denmark during the 1950's before leukosis control and eradication programs began. In 1992, only about 2% of the cows infected with BLV got lymph node tumors. The total number of animals infected with the virus has not been determined, but during the 1970s, about 20% of cows were estimated to be infected. In 1984, some states reported the prevalence of BLV-infected dairy cattle: Wisconsin (22.2%), Florida (47.7%), and Michigan (30%). Beef cows had lower rates ranging from .12 to 6.7%.

The increasing number of condemned carcasses suggests that current management of dairy cows is not preventing further BLV infections. Even though BLV is not easily spread from animal to animal, licking of blood and body secretions can contribute to its transmission. The higher the number of calves housed together, the greater the risk. Housing heifers in larger groups and calf management practices like gouge dehorning, ear tagging, and branding can contaminate feed areas and other facilities with blood. Multiple use of the same needle during routine vaccinations, use of unsterilized needles, and not changing gloves during insemination or pregnancy testing also can increase the number of BLV-positive animals.

Elimination Program

Establishing new management and veterinary practices is key to controlling the disease, because no vaccine is available.

Blood testing is the first step, so BLV-positive animals can be identified and grouped separately. Serological test results from animals younger than 6 mo of age may show false-positive results because of colostral antibodies that are still present. Pregnant animals should be serotested at least 6 wk before parturition to prevent false-positive results from immunoglobulins being shifted to colostrum. The separation of infected animals alone will

reduce incidence drastically when older BLV-positive cows are replaced by BLV-negative testing heifers.

Recommendations to reduce transmission of BLV follow:

- ✓ Only single-use disposable needles and palpation sleeves should be used and then discarded.
- ✓ A complete cleaning should be performed of all surgical instruments (those that come into contact with blood), such as for dehorning, castration, extra teat removal, tagging, and tattooing. These instruments also should be disinfected between uses.
- ✓ Biting insect numbers also need to be reduced.
- ✓ All cattle entering the herd should be tested for BLV and isolated for 30 to 60 days. These cattle should then be tested again at the end of the isolation period before entering the herd.
- ✓ Annual testing should be implemented for all animals. A 3- to 4-mo testing interval is preferred but may be impractical.
- ✓ Artificial insemination should be used for all breedings.
- ✓ Neither colostrum nor milk should be used from BLV-positive cows. Milk replacer or pasteurized milk should be fed to calves when BLV-free milk is not available.
- ✓ Intravenous tubes or needles, like those used to treat milk fever, should be stored in a disinfectant solution, such as Nolvasan, which is a good cold sterilizer.
- ✓ Calf delivery equipment also should be cold sterilized between uses.
- ✓ Do not use BLV-positive cows as recipients for embryo transfer. If a highly valuable donor is tested positive, implant embryos in BLV-negative testing cows and test the offspring of the donor to be sure they are BLV-free.

- ✓ Use smaller pen sizes for calves.
- ✓ Remove extra teats, insert eartags, and dehorn while calves are housed individually.
- ✓ Bloodless dehorning methods such as electric, hot iron, or caustic paste are recommended.
- ✓ Regularly clean feed and water containers to reduce blood contamination.
- ✓ Perform all veterinary procedures on BLV-positive cows last.
- ✓ Milk all BLV-positive cows last.

Complete eradication programs should be implemented by dairies that sell heifers, embryos, or semen so they can gain a BLV-free status. Some states have certification programs to identify BLV-free dairy herds. All states have some requirements in common such as: identification of sick animals by regular blood testing, establishing practices and procedures to prevent the spread of any blood or other fluids from BLV-positive to BLV-negative animals, and isolating infected from noninfected animals. Culling rates also may increase to rid the herd more quickly of positive cows and to reduce exposure of healthy animals.

Procedures

Limited published data exist on the incidence of BLV in U.S. dairy herds and even less on the incidence in Kansas herds. Further, information relative to the success or failure of recommended elimination procedures is lacking. A BLV testing and elimination program was initiated in the Kansas State University dairy herd in 1994 to provide data on the incidence of BLV and the effectiveness of using only colostrum and whole milk from cows exhibiting a negative BLV titer to feed heifer calves from birth to weaning.

All lactating cows and cows and heifers due to calve within 30 days were tested during May and June of 1994. The remaining cows and heifers were tested routinely when they were moved to the maternity area approximately 21 days before projected calving date. Colostrum

and whole milk from cows testing negative were used to feed heifer calves, whereas colostrum and whole milk from positive-testing cows were fed to bull calves because they would leave the herd at an early age. Procedures to eliminate transfer of the virus by needle, artificial insemination, pregnancy checking, blood sampling, and other mechanical means were instituted in the mid 1980s. Transfer by insect vectors and animal contact remains a possibility.

Results and Discussion

Approximately 55% of the 180 cows tested for BLV in 1994 showed a positive titer. One hundred and eleven (111) cows and heifers were tested for the first time in 1995, and 33.3% tested positive. Eighty-eight heifer calves have been tested for the first time in 1996 (January to August 15), and only 21.5% tested positive. Sixty-five of the heifers tested in 1996 received colostrum and whole milk from cows with a BLV-negative titer and only 12.3% tested positive. The decline in the percentage of positive-titer cows tested for the first time in 1995 is attributed to the fact that most of these were first calf heifers, whereas the 1994 group contained primarily cows in their second or greater lactation. The rationale was that heifers tested prior to 24 mo of age may be infected but do not show a positive titer. To test this supposition, 70 cows that

were negative when first tested were retested prior to their next parturition (Table 2), and 17.1% showed a positive titer. These data strongly support the recommendation that all BLV-negative cows should be retested annually to ensure a clean colostrum and milk supply for the next generation. Other studies have suggested that cows tested within 6 wk of parturition may show a false positive test. Our data do not support this suggestion. Thirty-five cows showing a positive titer on the first test were retested, with 33 testing positive and 2 testing negative. The two cows testing negative were confirmed positive with a third test.

The theory has been advanced that calves born to dams testing positive tend to be less susceptible to BLV than cows born to dams showing a negative titer. Results in Table 3 do not support this theory, because 19.4% of calves from positive dams tested positive by 24 mo of age, whereas only 3.8% of the calves from negative dams showed a positive titer. Some reports suggest that 5 to 10% of calves from cows showing a positive titer may acquire the virus by blood transfer during the birthing process. This could account for the increased number of positive titers in calves from positive dams in this study, because all calves reported in Table 3 received colostrum and whole milk from negative cows. However, definitive conclusions on this point should not be made from such a small sample population.

Table 1. Incidence of Bovine Leukosis Virus in the KSU Dairy Herd¹

Year	No. tested 1st time	No. (+)	% (+)	No. (-)	% (-)
1994	190	104	54.7	86	45.3
1995	111	37	33.3	74	66.7
1996 (Jan - Aug)	88	19	21.5	69	78.5
Program heifers ²	65	8	12.3	57	87.7

¹All mature cows were tested in 1994, regardless of stage of lactation. Bred heifers tested 21 days prior to projected calving date. Figures for 1995 and 1996 include only bred heifers tested for the first time 21 days prior to projected calving date.

²Heifers that received colostrum and whole milk from (-) cows.

Table 2. Value of Retesting Cows Showing Positive and Negative Titers for Bovine Leukosis Virus¹

	No. Tested	No. (+)	% (+)	No. (-)	% (-)
(+) 1st test	35	33	94.3	2	5.7
(-) 1st test	70	12	17.1	58	82.9

Table 3. Incidence of Bovine Leukosis Virus in Heifers Born to (+) and (-) Dams

	No.	(+)	% (+)	(-)	% (-)
Dam					
(+)	31	6	19.4	25	80.6
(-)	26	1	3.8	25	96.2
No previous test	8	1	12.5	7	87.5