牛白血病ウイルス感染牛群に対する経済的損失を伴わない清浄化対策

誌名	Japanese journal of veterinary science
ISSN	00215295
著者	大島, 寛一 岡田, 幸助 沼宮内, 茂
巻/号	50巻5号
掲載ページ	p. 1074-1078
発行年月	1988年10月

An Eradication Program without Economic Loss in a Herd Infected with Bovine Leukemia Virus (BLV)

Kan-ichi OHSHIMA, Kōsuke OKADA, Shigeru NUMAKUNAI, Hiroshi KAYANO[1)], and Taichi GOTO[1)]

Department of Veterinary Pathology, Faculty of Agriculture, Iwate University, Ueda, Morioka-shi, 020, and [1)]Technical Research Center, Koiwai Farm, Shizukuishi-cho, 020-05, Japan

(Received 26 April 1988/Accepted 9 July 1988)

ABSTRACT. An eradication program in a leukosis herd (80% positive) was designed since 1978, and performed successfully from 1982 to 1986 by checking BLV antibodies and generous segregation of positive cattle from the negatives. Slaughter of the positives were in due order, and good milk yield was resulted. The results obtained would be a good model of eradication program with the least economic loss.—KEY WORDS: bovine leukemia, dairy herd, eradication, milk yield, segregation.

Jpn. J. Vet. Sci. 50(5): 1074–1078, 1988

Enzootic bovine leukosis (EBL) is a disease caused by exogenous bovine leukemia virus (BLV). When the virus infection occurred, temporary viremia may onset in the host [8], then the virus is integrated as a provirus in DNA of infected lymphocytes [7] or neoplastic cells [16]. Although detectable antibodies are produced in the circulating blood [10], the provirus is protected from their effect and the infection continues as far as the host is alive, who plays a role of contaminating source [12].

BLV may be transmitted by transfer of infected lymphocytes into the susceptible new host, due to blood-sucking tabanid flies especially in the field condition [2, 12]. One more important thing is that less than 10% of calves born to BLV-infected dams are infected with BLV congenitally [13, 18]. Maternal antibodies transfered by colostrum in calves may disappear within 3 to 6 months of age [3, 11], but the positive antibodies may be effective for protection of oral infection with the virus from contaminated milk of their dams [4, 5, 21]. Furthermore, oral infection is likely to occur rather not so easy compared to the cutaneous route [15, 19]. Accordingly, establishment of a clean herd free from BLV infection will be possible by means of both elimination of cattle with positive antibodies to BLV antigen from the herd [20] and introduction of selected cattle with negative antibodies. Successful results using the idea were already obtained by several authors [1, 4, 6, 9, 14, 17, 22]. In highly contaminated herd, however, most of the cattle are positive for antibodies and eliminated, the herd itself will not be able to maintain unless a number of negative cattle should be introduced with a payment of vast funds.

This is an experimental record performed control of the disease with the least economic loss in a commercial dairy herd of about 500 cattle, in which approximately 80% had been positive for BLV antibodies.

MATERIALS AND METHODS

State of farm examined: The farm had kept approximately 500 dairy cattle in several blocks. One is breeding B herd. The 2nd is the milking M herd with 2 barns which were located about 1,500m far from the B herd. The 3rd barn is for delivery and calves

and located about 200m far from the B herd. By preliminary examinations since 1978, approximately 30%, and 80 to 85% of cattle had been estimated as positive for BLV antibodies in the B and M herd, respectively.

Experimental design: 1) Antibodies to BLV were checked by immunodiffusion test 2 to 3 times annually. 2) Positive cattle were under generous segregation from the negatives, but housed in the same barn with screen-windows and doors. 3) During the fly season, only negative cows were released in the paddock in the day time but positive cows were kept inside of the barn all day long until they are slaughtered. 4) Slaughter of positive cows and introduction of negative cows were gradually done in due order during the length of the program from 1982 to 1986. 5) The criteria for slaughter was age, milk yield and state of health. 6) During the program, milk-dried and delivery cows were moved to delivery barn. 7) All new-born calves were segregated from their dams after receiving colostrum and housed together in a rearing barn. 8) The calves were tested for BLV antibodies at 3 to 6 months of age. 9) The negative calves were retained in the herd, but the positives were slaughtered after they were rechecked at 6 months of age. The schema of the program is shown in Fig. 1.

RESULTS

At the beginning of the program, total of 75 BLV positive cows in the B herd were transfered to the M herd from 1978 through the spring of 1981. At this time, the breeding B herd had became free from BLV infection, and the positive rate of the M herd was 75.1%.

The positive rate was 72.8% in the spring of 1982, when the cleaning program of the M herd was started. Since the spring of 1982, cows were kept in 2 barns, in one of which (Barn I) only positive cows were kept, and in another barn (Barn II) both groups of positives and negatives were kept together within a same barn.

Since the spring of 1983, many negative cows were able to be introduced into the M

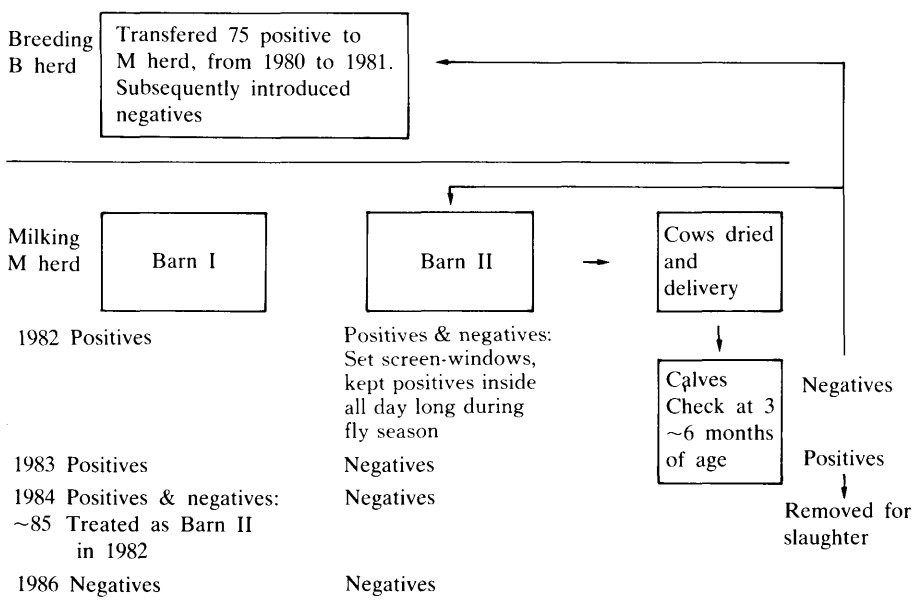

Fig. 1. Schema of cleaning program and the results.

Table 1. Transition of BLV antibodies in Milking M herd

Year	1980			1981		1982		1983		1984		1985	1986
Date	May 12	July 26	Nov. 27	Apr. 20*	Dec. 15	Apr. 19	Sep. 12	Apr. 15	Dec. 12	June 26	Dec. 8	Dec. 13	May 24
Negative	32	42	45	53	55	60	64	93	123	142	168	205	227
Positive	169	170	167	169	168	163	139	112	91	69	54	29	0
(Positive transition)	(7)	(0)	(1)	(4)	(14)	(0)	(2)	(3)	(3)	(1)	(0)	(2)	(0)
Unknown	0	0	1	3	1	1	1	0	0	0	0	0	0
Total	201	212	213	225	224	224	204	205	214	211	222	234	227
Positive rate (%)	84.1	80.2	78.4	75.1	75.0	72.8	68.1	54.6	42.5	32.7	24.3	12.4	0

Note. *Transfered all positive cows from B to M herd.

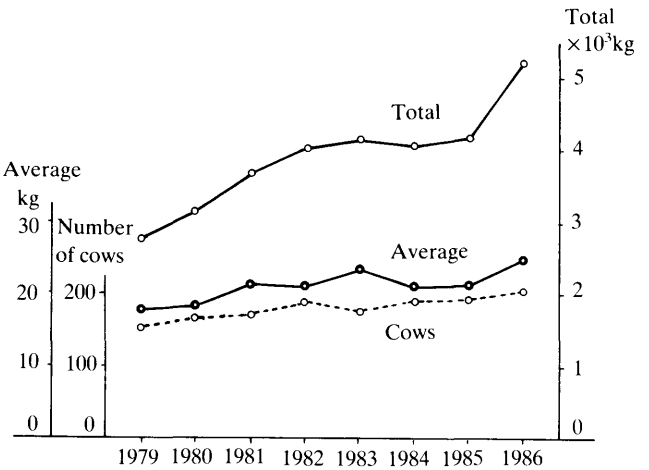

Fig. 2. Daily milk yield during May for 8 years.

herd back from the rearing barn, and excessive positive cows were able to be slaughtered. The positive rate was 54.6%, then positive and negative groups were able to separate each other into 2 barns.

In 1984, the positive rate became 32.7% in the herd, because slaughter of positive cows and introduction of negative cows were accelerated. In 1985, the positive rate became 12.4%. And before the spring of 1986, all of the positive cows were able to be eliminated. The BLV antibodies of the cattle in the herd had checked in the fall of the same year as well as in the spring of 1987, no one showed positive reaction. Changes of percentage of BLV positive cows during the preprogram stage for 1980 to 1981 as well as the program stage from 1982 through 1986 were shown in Table 1. Positive transition cows were counted 8 and 18 in 1980 and 1981 of the preprogram stage, but the number decreased to 2, 6, 1, 2 or 0 in the following years of the program stage, respectively. As a whole, total 249 cows (247 negatives, 2 positives) were brought in the herd from their own descendants instead of 246 removals (64 negatives, 181 positives, one unknown) during the course of the program.

The number of milk yielding cows increased from 156 in 1979 to 208 in 1986 according as the increase of total number of cattle in the M herd as shown in Fig. 2. The milk yield of all cows, both positives and

negatives in the M herd is also increased gradually. Total milk yield per day in average of May was increased by 140% from 3,720 kg in 1981 to 5,220 kg in 1986. This value meams increase by 117% from 21.5 kg in 1981 to 25.1 kg in 1986 per head.

DISCUSSION

It was shown that the check and generous segregation method was effective and useful for eradication program of leukemic herd with least economic loss. The present program was scheduled for prevention of transmission due to blood-sucking tabanid flies, and the rate of positive transition was extremely low during the program compared to that of preprogram stage. The results will indirectly but clearly support the opinion that tabanid flies had been played an important role of horizontal transmission of BLV in the field condition [12]. Furthermore, good results were obtained for milk yield after eradication of BLV-positive cows in the herd. Although the reason is obscure exactly, it might be also due to such additional uncertain factors as that average age of the herd became younger, that less excellent cows were preferentially eliminated regardless to the name value of the breed, and that good grass grow had recorded in the spring of 1986, etc.

ACKNOWLEDGEMENTS. This work was supported in part by Grant-in-Aid for Scientific Research No. 62304028 from Ministry of Education, Science and Culture of Japan, and by Grant-in-Aid for Special Coordination Funds from the Science and Technology Agency of the Japanese Government.

REFERENCES

1. Bause, I., Maas-Inderwiesen, F., and Schmidt, F.-W. 1978. Results of an epidemiological survey of enzootic bovine leukosis in the northern part of Lower Saxony and a preliminary communication of an examination into relationship between BLV-antibody development and calving. *Ann. Rech. Vet.* 9: 765–769.
2. Bech-Nielsen, S., Piper, C. E., and Ferrer, J. F. 1978. Natural mode of transmission of the bovine leukemia virus: Role of blood sucking insects. *Am. J. Vet. Res.* 39: 1089–1092.
3. Burridge, M. J., Thurmond, M. C., Miller, J. M., Schmerr, M. J. F., and Van Der Maaten, M. J. 1982. Duration of colostral antibodies to bovine lekemia virus by two sereologic tests. *Am. J. Vet. Res.* 43: 1866–1867.
4. Ferrer, J. F. 1982. Eradication of bovine leukemia virus infection from a high-prevalence herd using radioimmunoassay for identification of infected animals. *J. Am. Vet. Med. Ass.* 180: 890–893.
5. Ferrer, J. F., and Piper, C. E. 1981. Role of colostrum and milk in the natural transmission of the bovine leukemia virus. *Cancer Res.* 41: 4906–4909.
6. Kaja, R. W., Olson, C., Rowe, R. F., Stauffacher, R. H., Strozinski, L. L., Haradie, A. R., and Bause, I. 1984. Establishment of a bovine leukosis virus-free dairy herd. *J. Am. Vet. Med. Ass.* 184: 184–185.
7. Kettmann, R., Cleuter, Y., Mammerickx, M., Meumier-Rotival, M., Bernardi, G., Burny, A., and Chantrenne, H. 1980. Genomic integration of bovine leukemia provirus—Comparison of persistent lymphocytosis with lymph node tumor form of enzootic bovine leukosis. *Proc. Natl. Acad. Sci. USA* 77: 2577–2581.
8. Kono, Y., Sentsui, H., Arai, K., Iishida, H., and Irishio, W. 1983. Contact transmission of bovine leukemia virus under insect free conditions. *Jpn. J. Vet. Sci.* 45: 799–802.
9. Mammerickx, M., Cormann, A., Burny, A., Dekegel, D., and Portetelle, D. 1978. Eradication of enzootic bovine leukosis based on the detection of the disease by the gp immunodiffusion test. *Ann. Rech. Vet.* 9: 885–894.
10. Ohshima, K., Miura, S., Numakunai, S., Yasuda, Y., Takahashi, K., Izawa, F., Ozai, Y., and Omi, K. 1978. Precipitating antibodies against internal viral antigen from C-type bovine leukemia virus. *Jpn. J. Vet. Sci.* 40: 87–91.
11. Ohshima, K., Morimoto, N., Kagawa, Y., Numakunai, S., Hirano, T., and Kayano, H. 1984. A survey on decay of maternal antibodies to bovine leukemia virus (BLV) in calves born to cows infected with BLV. *Jpn. J. Vet. Sci.* 46: 583–586.
12. Ohshima, K., Okada, K., Numakunai, S., Yoneyama, Y., Sato, S., and Takahashi, K. 1981. Evidence on horizontal transmission of bovine leukemia virus due to blood-sucking tabanid flies. *Jpn. J. Vet. Sci.* 43: 79–81.
13. Ohshima, K., Takahashi, K., Okada, K., Numakunai, S., Kagawa, Y., and Minamino, K. 1982. A pathological study on fetuses and placentas

from cows affected with enzootic bovine leukosis with reference to transplacental infection of bovine leukemia virus. *Jpn. J. Vet. Sci.* 44: 479–488.
14. Roberts, D. H., and Bushnell, S. 1982. Herd eradication of enzootic bovine leukosis. *Vet. Rec.* 111: 487.
15. Roberts, D. H., Lucas, H. H., Wibberleg, G., and Chasey, D. 1982. An investigation into the susceptibility of cattle to bovine leukosis virus following inoculation by various routes. *Vet. Rec.* 110: 222–224.
16. Sagata, N., Ogawa, Y., Kawamura, J., Onuma, M., Izawa, H., and Ikawa, Y. 1983. Molecular cloning of bovine leukemia virus DNA integrated into the bovine tumor cell genome. *Gene* 26: 1–10.
17. Thurmond, M. C., and Burridge, M. L. 1982. Application of research to control of bovine leukemia virus infection and to exportation of bovine leukemia virus-free cattle and semen. *J. Am. Vet. Med. Ass.* 181: 1531–1534.
18. Thurmond, M. C., Carter, R. L., Puhr, D. H., Burridge, M. J., Miller, J. M., Schmerr, M. J. F., and Van Der Maaten, M. J. 1983. An epidemiological study of natural *in utero* infection with bovine leukemia virus. *Canad. J. Comp. Med.* 47: 316–319.
19. Van Der Maaten, M. J., and Miller, J. M. 1977. Susceptibility of cattle to bovine leukemia virus infection by various routes of exposure. pp. 29–32. *In*: Advances in Comparative Leukemia Reasearch 1977 (Beutvelzen, P., Higers, J., and Yohn, D. S. eds.), Elsvier, North Holland Biomedical Press, Amsterdam.
20. Van Der Maaten, M. J., and Miller, J. M. 1979. Appraisal of control measures for bovine leukosis. *J. Am. Vet. Med. Ass.* 175: 1287–1290.
21. Van Der Maaten, M. J., Miller, J. M., and Schmerr, M. J. F. 1982. Factors affecting the transmission of bovine leukemia virus from cows to their offspring. pp. 225–243. *In*: Fourth International Symposium on Bovine Leukosis (Straub, D. C. ed.), Matinus Nijhoff Publishers, The Hague, Boston, London.
22. Yoshikawa, Y., Yoshikawa, H., Koyama, H., and Tsubaki, S. 1982. Preliminary attempts to eradicate infection with bovine leukemia virus from a stock farm in Japan. *Jpn. J. Vet. Sci.* 44: 831–834.

要　約

牛白血病ウイルス感染牛群に対する経済的損失を伴わない清浄化対策：大島寛一・岡田幸助・沼宮内茂・萱野裕是[1)]・後藤太一[1)]（岩手大学農学部家畜病理学講座，[1)]小岩井農場技術研究センター）——1978年から予備調査を行い，約80％が牛白血病ウイルス（BLV）抗体陽性を示した約500頭の乳牛群について1982年から清浄化対策を実施し，5年後の1986年に計画を達成した．BLV抗体を年2～3回検査し，アブの飛来時期に重点を置いて陽性牛を緩やかに分離飼育した．と殺は陽性牛を優先するものの，陰性子牛を牛群に還元しつつ生産の低下を来さないよう，泌乳量および一般健康状態を重視して実施した．結果的に牛群および個体の平均泌乳量は増加した．この計画は経済的損失をもたらすことなく実施可能であり，清浄化モデルとなり得るものと考えられた．