EPIDEMIOLOGY OF BOVINE LEUKEMIA VIRUS INFECTION IN DAIRY CATTLE

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The bovine leucoses are highly fatal malignant neoplastic conditions of cattle characterized by the development of lymphosarcomata in almost any organ. Each lymphosarcoma is an aggregation of neoplastic lymphocytes formed into a firm white tumor mass. Two distinct types of bovine leucosis are seen in dairy cattle:

1. Sporadic bovine leucosis which is rare, affects cattle less than 3 years of age, and occurs in single animals in a herd with no evidence of spread. There are three forms of the disease:
   a) Calf form which affects cattle less than 6 months old and is characterized by sudden enlargement of all lymph nodes.
   b) Thymic form which affects cattle 6-30 months old and is characterized by massive enlargement of the thymus.
   c) Skin form which affects cattle 18-30 months old and is characterized by cutaneous plaques.

2. Enzootic bovine leucosis which is more common, affects mainly adult cattle more than 3 years old, and spreads slowly through an infected herd. It is causally related to bovine leukemia virus infection.

Bovine leukemia virus infection and the associated disease, enzootic bovine leucosis, will form the subject of this review.

Bovine Leukemia Virus

Bovine leukemia virus (BLV) is an oncornavirus (RNA tumor virus) that has a widespread geographical distribution. It is readily destroyed by physical agents such as heat, including pasteurization of milk.

Host Range

Cattle are the important host of BLV. Sheep and goats have been experimentally infected with BLV, but natural infection in these species appears to be rare. BLV infection has never been detected in either man or wild animal species.

Prevalence of BLV Infection

BLV infection has been detected serologically in dairy cattle throughout the United States. Herd prevalence has varied from 0-79%. Prevalence of BLV infection, as detected by serological tests, increases with age of dairy cattle during their first 5 years of life.
Clinical Signs

The majority of cattle infected with BLV never show overt signs of disease. The incubation period of enzootic bovine leucosis is long with most cases occurring a number of years after initial infection with BLV. Clinical signs commonly seen in dairy cattle include enlargement of superficial lymph nodes, loss of appetite, and marked drop in milk production. Animals lose condition rapidly and die within weeks or a few months of the first signs of disease. A small proportion of cases run a peracute course and die suddenly without showing prior signs of illness.

Diagnosis

Hematology and serology are useful aids to the diagnosis of enzootic bovine leucosis but confirmation of diagnosis requires histological examination of the tumor masses:

1. Histology: suspect neoplastic material is examined microscopically to confirm that it is from a lymphosarcoma.

2. Hematology: in many cases there is a marked lymphocytosis (immature lymphocytes prominent) with lymphocyte counts rising from a normal of about 6,000 to 150,000 / cu. mm.

3. Serology: detection of antibodies in the agar gel immunodiffusion test using a BLV-glycoprotein antigen is indicative of past infection with BLV.

Transmission

Detailed knowledge of the transmission of BLV is very incomplete because of the long incubation period before development of clinical disease and the fact that sensitive and specific serological tests are of recent introduction.

1. Transmission between herds:
   a) Cattle movements: transmission between herds seems to depend largely on the introduction of infected asymptomatic animals. It appears that BLV infection was introduced into Great Britain in the early 1970s through the importation of infected Holstein cattle from Canada.
   b) Biological products: premunization against babesiosis using whole blood has been incriminated in situations where the donor animal was infected with BLV.
   c) Semen: there is no evidence of transmission of BLV via semen.

2. Transmission within herds:
   a) Prenatal infection: transplacental transmission of BLV from dam to fetus does occur, but it accounts for less than 20% of infected cattle.
   b) Colostrum: transmission of BLV from dam to calf via colostrum can occur, but it appears to be an infrequent event.
   c) Horizontal transmission: the major mode of transmission of BLV between cattle is unknown. There is some evidence that blood-sucking flies may be involved. Accidental transmission of BLV during routine blood sampling has occurred, emphasizing the importance of using a sterile needle for each animal during such procedures.
Economic Losses

Direct economic losses result from mortality and condemnation of carcasses with lymphosarcoma at slaughter. The possible effects of asymptomatic BLV infection on dairy productivity are unknown.

Consequential losses from BLV infection may be the most serious economic effect for the dairy farmer. Eradication of enzootic bovine leucosis has been established as a goal in the European Economic Community (EEC) and pressure is increasing to introduce legislation to prohibit importation into EEC countries of cattle that are positive for BLV antibodies on the immunodiffusion test. Therefore, the mere presence of BLV infection in a herd might affect the ability of a farmer to export cattle to EEC countries in the future. In addition, many European importers of semen demand certification of freedom of the donor bull or its herd of origin from BLV infection even though transmission of virus via semen has never been demonstrated.

Research at the University of Florida

A joint research project between the College of Veterinary Medicine and the Dairy Science Department of the Institute of Food and Agricultural Sciences (IFAS) is studying BLV infection in cattle in Florida. Our initial work has concentrated on genetic aspects of BLV infection in the IFAS Dairy Research Unit herd. From that study, a heritability estimate of 0.48 was determined, suggesting considerable genetic influence on susceptibility to BLV infection. Since the heritability study considered only one dairy herd, the results must be confirmed by examination of an appropriate sample of dairy herds from throughout Florida. It is only after such work that the potential of genetic selection as a simple and inexpensive method for the control of BLV infection (and thus of enzootic bovine leucosis and bovine lymphosarcoma) can be evaluated.

Our future research program will be directed towards the solution of 4 unanswered questions:

1. What is the extent of BLV infection in Florida dairy herds?
2. What is the economic impact of BLV infection on dairy productivity? Consideration will be given to milk yield, milk quality, neonatal calf mortality, calf viability, and the possibility that BLV can act as an immunosuppressive agent and thus influence the susceptibility of dairy cattle to other diseases.
3. What is the extent of genetic influence on susceptibility of dairy cattle to BLV infection?
4. What are the methods of horizontal transmission of BLV and how important are prenatal and colostral transmission?

Review References
