Epidémiol. santé anim., 1997, 31-32

A NOVEL APPROACH TO DISEASE CONTROL. AN INDUSTRY OPERATED PROGRAMME FOR BOVINE LEUKAEMIA VIRUS IN NEW ZEALAND

Burton L.[1], Allen G.[2], Hayes D.[1], Pfeiffer D.[3], Morris R.[3]

L'industrie laitière néo-zélandaise a conçu et mis en place un plan national d'éradication du virus de la leucose bovine enzootique (VLBE). Le plan se déroulera sur une période de 8 ans, avec pour objectif de rendre le cheptel indemne de VLBE. Plus de 96 pour cent des vaches laitières sont enregistrées dans une base de données centrale avec un système d'identification pérenne. 90 pour cent des cheptels font régulièrement l'objet de prélèvements individuels de tous les animaux en production dans le cadre d'un système national de contrôle de performances de production laitière.

Des enquêtes épidémiologiques ont été conduites en vue d'orienter la conception de stratégie du dépistage, et pour identifier les facteurs de risque d'intérêt particulier pour ce plan de lutte. Une étude transversale a montré que 6,5 % environ des cheptels sont infectés, avec un taux moyen d'animaux infectés par cheptel de 3,7 %.

Le statut des cheptels est déterminé à l'aide d'un test ELISA du commerce réalisé sur des prélèvements de lait de mélange. Dans les cheptels reconnus infectés, les tests Elisa sont effectués sur les laits individuels. La contamination des échantillons lors de la traite ou lors de la réalisation du test de dépistage provoque une proportion importante de résultats faussement positifs dans les cheptels infectés. C'est pourquoi, tous les résultats individuels positifs en ELISA sont soumis à un ELISA complémentaire réalisé sur sérum pour confirmation. Les vaches taries sont contrôlées par un ELISA sur leur sérum. Les cheptels seront reconnus indemnes de VLBE après fourni un résultat négatif à tous les contrôles réalisés au cours d'une période de trois années consécutives. Ce plan évite de procéder à des prélèvements supplémentaires dans les élevages pour plus de 90 pour cent des cheptels de la Nouvelle Zélande, qui devraient conserver un statut négatif. La plupart des vaches laitières de Nouvelle Zélande mettent bas au printemps et à la période de pâturage. Selon ce plan, il sera recommandé d'abattre les animaux à sérologie (LBE) positive à la fin de la saison qui suivra le constat du résultat sérologique positif.

Many countries have implemented control programmes for Enzootic Bovine Leucosis (EBL). Some of these schemes have been compulsory, but others including those operating in Australia are voluntary (Ross et al. 1994). The New Zealand dairy industry has agreed to implement and fund a national disease eradication programme for Bovine Leukaemia Virus (BLV) that began in 1996. The scheme will operate over an eight year period with the aim of industry freedom from BLV. Greater than 96 percent of all dairy herds are recorded with permanent individual animals identification on a centralized national database (Livestock Improvement Corporation, 1996). Ninety percent of herds also submit whole herd sample sets to a national milk analysis centre for individual cow production testing on a regular basis. This national recording system and the ability to test milk samples for BLV using ELISA (enzyme linked immunosorbent assay) technology has provided a novel opportunity to control EBL in New Zealand. Although the scheme is voluntary it is supported by all groups within a vertically integrated industry. As the scheme approaches completion it is anticipated that the control of EBL within dairy herds will be a condition of supplying milk to factories.

EPIDEMIOLOGY

New Zealand dairy herds are fed pasture and are typically large and seasonally calving. Herds are managed so that all cows calve on a synchronous annual cycle that best matches feed demands with pasture availability. Most herds calve in a six to eight week period in late winter and early spring. There are approximately 15,000 herds which average 210 milking cows during peak production in October and November of each year.

A series of epidemiological studies have been conducted to determine the disease prevalence and incidence and to guide decisions with regard to diagnostic testing strategies as well as to identify any risk factors which could be addressed specifically during the programme implementation. A random sample of 1700 herds were initially tested for BLV using an aggregate test of individual milk samples collected from the national milk analysis centre using commercially available elisa tests. Approximately 6.5 percent of herds were identified as positive to BLV. Regional herd prevalence varied significantly from a low of 2.5 % to a high 10 %. Twenty positive herds were subsequently enrolled in a longitudinal study to examine the temporal pattern of disease within herd and to provide milk and blood samples for test validation. Within herd prevalence of BLV ranged from 0.2 % to 25 % with an estimated mean of 3.7% after adjusting for test sensitivity and specificity. During a period of twelve months that these herds have been monitored there has been few incidence cases within herd. These herds and a preliminary evaluation of a case control study suggests that the purchase of positive animals from infected

1 Livestock Improvement Corporation, Hamilton, New Zealand
2 Ministry of Agriculture Regulatory Authority, Wellington, New Zealand
3 Department of Veterinary Clinical Science, Massey University, Palmerston North, New Zealand

herds or from herds with an unknown status is the single most important risk for herds becoming infected in New Zealand.

SAMPLE COLLECTION

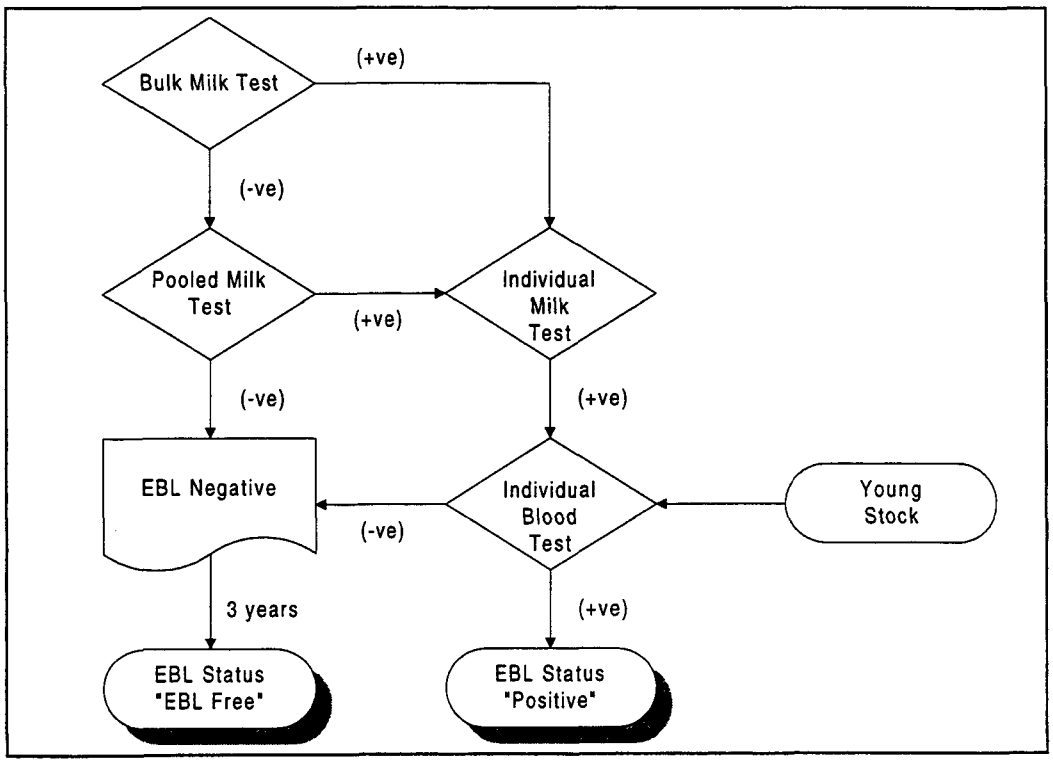
The initial proposal to control EBL in New Zealand required that milk samples already collected for production testing and samples of vat milk supplied by the dairy companies be used to establish herd EBL status. This proposal required no additional on-farm sample collection for all herds that test negative and could provide significant economic benefits. It was necessary however to establish the sensitivity and specificity of these test methods. In some infected herds individual milk samples were collected directly from a single quarter to determine the concordance between milk and blood samples processed by independent laboratories and between these milk samples and milk samples derived from automated production testing. The milk samples collected for production testing were shown to be cross contaminated within herd, but there was no contamination identified across herd. Contamination occurred at sample collection from the automated collection equipment and from the normal processing of samples for production testing. The negative predictive value of an ELISA test of such milk samples approached 1.0, but the positive predictive value was approximately 0.38. Confirmation of positive test results using individually collected blood or milk was therefore essential, but this screening method was capable of detecting virtually all BLV cases. Incorrect animal identification at herd production test was not found to be a significant problem during these sample evaluations .

Detailed comparative studies of the different commercial elisa kits were also carried out to identify those methods most suitable for the screening of milk samples given the scheme requirements for these samples and for the confirmatory blood tests.

SCHEME DESIGN

ELISA testing of bulk milk samples has been previously shown to detect herds with a BLV prevalence of greater than 5% (Klintevall et al. 1991). As New Zealand herds are large and the within herd prevalence of BLV is often below 5% the control scheme determines herd BLV status using parallel testing of bulk milk and production test milk samples with a commercially available ELISA test (Figure1). All individual production milk samples are tested, but are aggregated into 20 cow pools to minimise the testing required to determine herd status. Herds will be declared free of EBL after testing negative to this regime annually for three consecutive years. The scheme requires that the number of cows included in each screening test must be sufficient to be 95 percent confident of detecting herds with a prevalence of greater than 1 percent. This testing scheme removes any requirement for additional on-farm sample collection for greater than 90 percent of herds in New Zealand which are expected to maintain a negative test status.

Figure 1
Annual EBL testing schedule for all New Zealand dairy herds



Herds are considered EBL negative if both the vat and aggregate testing of production test milk samples are negative. Herds are classified as infected if either a bulk milk sample or pooled production test sample are positive. In these cases production test samples are then used to identify individual cases within herd. Cows with a negative test are classed as uninfected. In the case of a positive individual milk test result a second confirmatory test of a blood sample is required because of the sample contamination. The blood test result is used as the single criteria to determine the disease status of these animals. All non-lactating animals in a positive herd also have serum collected for BLV ELISA tests.
All herds in the country will have been screened by the end of 1997 and the process will then be continued annually. The national database and the recording of individual lifetime identification for almost all dairy cows in the country allows for the tracing animals between herds. Herd EBL status is printed on the production test reports and various other management reports that are supplied to farmers from the national database on a regular basis.
Veterinarians are contracted by the scheme operators to provide expert advice to the owners of positive herds on the most appropriate control strategies required for the particular herd. Ensuring that all farmers are adequately aware of the disease and encouraged to only purchase stock from negative herds will be essential if the scheme is to succeed within the budgeted 8 year time frame.
Vat milk and herd production test milk samples are of value only when most cows are lactating. The seasonal calving pattern provides a unique opportunity to screen virtually all cows during the six month period after calving is completed in late August.

CONCLUSION

Although the testing regime requires serial testing of herds and some cows in positive herds the scheme has significant economic benefits compared with traditional individual sample collection of all cows. Herds that test negative to the ELISA test of vat samples and aggregate testing of production test milk samples will not require any additional on-farm testing which also reduces costs. Herd test production samples can be used to initially identify individual positive cows as the within herd disease prevalence is low and the total number of animals that will require confirmatory blood samples will represent a small proportion of all animals. The accurate animal identification on the national database and the ability to trace the movement of animals allows for close monitoring of animals from infected herds and therefore should reduce the risk of herds becoming infected due to the introduction of ELISA test positive animals. The vertically integrated industry has resulted in an initiative that has the support of all groups and although the scheme is voluntary it is anticipated that most herds will aim to achieve a negative EBL status as rapidly as possible.

REFERENCE LIST

Ross A., Kirkland P., Zelski R., 1994. The NSW EBL Eradication Scheme. Australian Association of Cattle Veterinarians "Canberra" Proceedings, 58-63.

Livestock Improvement Corporation. 1996 Dairy Statistics, 5-10.

Klintevall K., Naslund K., Svedlund G., Hajdu L., Linde N., Klingborn B., 1991. Evaluation of an indirect elisa for the detection of antibodies to bovine leukaemia virus in milk and serum. Journal of Virological Methods 33, 319-333.