LONG-TERM SEROLOGICAL MONITORING AS A TOOL FOR EPIDEMIOLOGICAL INVESTIGATION OF NEOSPORA CANINUM INFECTION IN A NEW ZEALAND DAIRY HERD

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Worldwide, *Neospora caninum* is now being considered one of the major causes of abortion in cattle.[1] A number of studies have been conducted in different countries around the world to investigate the epidemiology of the parasite in cattle populations. A significant aspect of these investigations has been to identify the most important transmission mechanisms. Only recently has the dog been identified as definitive host of *Neospora caninum*, but other carnivores may also be implicated. Vertical transmission between dams and their calves has also been identified as an important route for infection.[2] The importance of the different mechanisms is likely to vary between dairy production systems depending on environmental and cattle management factors. New Zealand dairy cattle production is unusual as cattle are grazed all-year round and most herds are purely pasture-fed. In addition, dogs are used by most farmers for the management of the animals on a daily basis, when moving the herd two times daily from the pastures to the milking shed. The objective of the current study was to describe the dynamics of *N.caninum* infection through an intensive long-term serological investigation of a large dairy herd in New Zealand which had experienced an abortion storm resulting in 12% abortion losses in the 1996/97 lactation period.

Materials & Methods

The outbreak occurred in the first half of 1997 in a spring-calving 600 cow crossbred Friesian/Jersey herd in the North Island of New Zealand. During the study period, a total of 6376 blood samples were collected from bulls, steers, heifers, cows and calves on 9 sampling occasions between May 1997 and January 1999. An ELISA test developed in New Zealand was used to determine the infection status of the animals serologically.[3] Detailed cow histories were obtained from records in the dairy herd management software DairyWIN (Livestock Improvement Corporation, Hamilton, New Zealand). Histopathologic diagnosis of neosporosis was confirmed in 4 of 6 aborted fetuses submitted to the local MAF diagnostic laboratory. No other bacterial or viral cause of abortion was identified. Abortions were confirmed by rectal pregnancy diagnosis. The data had to be manipulated extensively through setting up a relational database structure in Microsoft Access 97 (Microsoft Corp., Redmond,

WA, USA). It was analysed statistically using chi-squared analyses and repeated-measures analysis of variance with the statistical software SAS for Windows 8.0 (SAS Institute, Cary, NC, USA).

Results

Over the two successive lactation periods 96/97 and 97/98, a total of 92 abortions were recorded in 876 adult cows at risk representing a total of 1472 cow years, resulting in an abortion risk of 6.25% per cow year. One cow aborted during two successive lactation years. Three dogs on the farm were bled during June 97 and tested for *N.caninum* antibodies using the fluorescent antibody test. Two of the dogs were weakly positive with titres of 1/50. Examination of faeces from one dog did revealed coccidial oocysts. Sixty-nine abortions occurred in the 96/97 lactation period between 17 February and 18 July 1997. Of these 28 abortions were observed during the first half of April. In the 97/98 lactation period 23 abortions occurred between February and July 1998. Prior to the observed outbreak abortion risks had been between 2 and 4% per lactation period. Seroprevalence was 50% during the May 97 sampling in calves born in 96 and heifers born in 95. It increased for the October 97 sampling in both groups, when calves born in 97 were included. During the following year prevalence remained low in calves, whereas heifers experienced another peak in prevalence in May and June 98. Cows did have sero-prevalences of about 50% in spring/summer 97, and less than 10% during the following year. Serological reactivity increased in some aborting cows around the time of abortion, but for most cows there was no clear pattern as indicated by a flat loess regression line. Of the 307 animals with 9 samples 27% were consistently serologically negative. Cows which had a positive ELISA test during the May 1997 sampling were 3 times (95% CI 1.36-6.51) as likely to have aborted during the 96/97 lactation period as cows which did have a negative test result. In the 96/97 lactation period, abortion risk was highest in heifers, whereas during the next lactation period there was no association with age. Heifers and dams born from cows which tested at least once positive were 2.2 times (95% CI 1.1-4.7) as likely to abort as those which always tested negative. There was no association between serological status of dams and offspring (RR=1.1, 95% CI 0.99-1.3). A repeated-measures mixed model was used to assess the relationship between serological infection status and milk production. After inclusion of indicator variables for amount of Jersey genetics (> 50%), age category, herd test number and lactation year as well as the interaction terms between Jersey genetics and age category, and between herd test number and lactation year, the model included significant fixed effects for serological status (at least once positive) and the interaction between serological status and lactation year in the case of milk volume, protein and solids. Milk volume was 0.4 liters ($F=6.0$, df 1 / 1480, $p=0.010$) higher in serologically positive cows across both lactation years, whereas the effect varied for milk protein and fat between the two lactation years.

Discussion

The study confirms that serological diagnosis is not a predictor of high accuracy of Neospora associated abortions in cattle.[4,5] It was particularly notable to observe significant variability in serological response across serial samples from most animals. In fact, only a third of animals sampled 9 times consistently responded at optical densities below the cut-off point of 0.15. In addition there was no consistent increase in reactivity around the time of abortions. This may indicate that some of the abortions were not caused by *N.caninum*. Given the current understanding about abortion causes common in New Zealand dairy cattle this is unlikely to be the case. The pattern of the abortion occurrence reflects a typical example of an outbreak situation, in that the risk increased from around 2-4% to almost 30% in the 96/97 lactation period. It is only possible to speculate about the cause of the outbreak which could be associated with environmental stress or secondary to infection with other agents such as BVD virus. It is interesting that there was a significant but not very strong association between the serological status of the dam and the abortion risk in their offspring. This may provide an indication of vertical transmission. The observed increased milk production in serological positive animals is difficult to explain. It may be that it is the result of differential selection bias, in that the farmer is more likely to keep high-producing than low-producing aborting cows. Assuming a significant vertical transmission risk farmers adopting this practice may, in fact, maintain infection within their herds.

References

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