Persistent Infection and Sub-Clinical Bovine Viral Diarrhea Virus Transmission in Dairy Calves

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Introduction

Clinical disease associated with Bovine Viral Diarrhea Virus (BVDV) has been well documented in the literature and includes respiratory, enteric, hemorrhagic, and reproductive problems. While sub-clinical presence of BVDV in herds is also acknowledged, its significance and impact on animal health and herd economics are not well understood. The objective of our ongoing study is to understand BVDV transmission and how the virus becomes established at a sub-clinical level in typically managed herds. In the first phase of the project, reported here, we focused on identifying sources and extent of BVDV transmission in dairy herds.

Materials and Methods

Ten dairy herds, ranging from 364 to 3921 animals (mean 1022) underwent a whole-herd test to detect BVDV persistent infection (PI) using pooled-sample polymerase chain reaction (PCR). Approximately 200 calves on two, 2000-cow herds were tested at birth (pre-colostrally) and at 30 days of age by PCR to identify BVD viremia. They were also tested for BVDV antibody at birth; 1-3 days of age; bi-weekly for two months; and at 45-day intervals to nine months of age. Exposure to BVDV was identified by a three-fold seroconversion, using virus neutralization to BVDV I (NADL) and BVDV II (c125). Various BVDV vaccination programs were in place in the 12 herds used in this study.

Results and Discussion

The rate of BVDV PI among the 10 herds ranged from 0% to 2% (mean 0.4%), including two herds with no BVDV PI, five herds with a single PI, one herd with two PI, one herd with eight PI and a single herd with 19 PI animals. Age of BVDV PI animals ranged from two months to four years, with 30 of the 34 PI animals (88%) less than 12 months of age. In the three herds with multiple PI calves, the calves generally clustered in age within a 28-day period. Among the ~400 calves monitored for 9 months, 0.4% in Herd A (1 calf) and no calves in Herd B had BVDV PI. In the same cohorts, 10% of the calves in Herd A and 7% in Herd B were born viremic for BVDV or had pre-colostral BVDV antibodies, indicating BVDV congenital infection (CI) during mid- to late-gestation. There was no difference in morbidity ($p>0.2$) or mortality ($p>0.2$) for the CI calves, compared to non-CI calves.

The high rate of CI in apparently healthy calves was unexpected, and challenges the widely held belief that BVDV exposure during gestation routinely results in weak calves, congenital defects or stillbirths. Additionally, the 7% to 10% CI rate provides a surprising estimate of the BVDV exposure rate in the pregnant herds.

Postnatal exposure of calves differed between the two dairies, with 79% of calves on Dairy A, and 38% on Dairy B, showing serologic evidence of BVDV exposure, unrelated to vaccination, by nine months of age. The majority of BVDV exposures on the two dairies occurred after calves were moved from calf ranches to group pens on the dairies, with the maximum risk of BVDV exposure occurring at seven months of age on both dairies. The highest exposure risk to BVDV was 18 new infections per 1000 calf-days-at-risk on Dairy A, and six new infections per 1000 calf-days on Dairy B.

Though there was no clinical disease associated with BVDV on either dairy during the trial period, it is apparent from these preliminary data that virus was maintained in the herds at levels resulting in a considerable amount of transmission between animals.