

The Survival of Bovine Viral Diarrhea Virus on Materials Associated with Livestock Production

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Introduction

Although research has demonstrated bovine viral diarrhea virus (BVDV) can be transmitted by a fomite, there are no published studies on the longitudinal survival of BVDV on common materials and within liquids used in livestock production that could serve as fomites. The objective of this study was to evaluate the longitudinal survival of a type 1b, non-cytopathic (NCP) BVDV on fomites in the presence or absence of a novel, synthetic mucus.

Materials and Methods

The BVDV strain CA0401186a (NCP BVDV 1b) was used for testing survival on materials (Dr. Julia Ridpath NADC, Ames, IA). A 4.1 log₁₀ median tissue culture infective dose (TCID₅₀)/ml was diluted in either phosphate buffered saline (PBS; pH=7.4; Cellgro, Manassas, VA) or a 20% mucus/PBS solution (pH = 7.4). Viral solutions were applied to paper, latex glove, clothing (Hanes T-shirt and denim jean), wood (untreated pine), rubber (Wellington boot), soil, total mixed ration, metal (galvanized and enameled), a mineral block, a salt block, and a molasses urea block, water, and phosphate buffered saline. Samples were eluted and collected at defined intervals (1, 2, 4, 6, 8, 24, 48, and 96 hours) after virus was applied to the materials. Elutions for each time point were subjected to a 3-pass virus isolation on bovine turbinate cells. After the third passage, cells were fixed and an immunoperoxidase assay was used for the detection of BVDV. For the data analysis, after achieving a satisfactory model, the PVALUE procedure in STATA™ (College Station, TX) was used to achieve model adjusted risk estimates and corresponding 95% confidence intervals for the risk of finding virus present at each time point for each fomite (metal, wood, rubber, etc...) and treatment (PBS and mucus).

Results

Overall, the chance of BVDV being recovered from a material decreased as the length of incubation

increased for both the mucus viral suspension (MV) and PBS viral suspension (PV). Additionally, virus in the presence of mucus had a greater chance of being recovered from some materials. Characterization of BVDV survival on paper demonstrated there was a 94% chance that BVDV would be recovered at one hour for MV and a 62% chance that BVDV would be recovered at one hour for PV. By 48 hours post incubation, there was < 7% chance that BVDV would be present in either group. Characterization of survival in soil demonstrated there was a 48% chance that BVDV would be recovered at one hour for MV and a 9% chance that BVDV would be recovered at one hour for PV. After eight hours, there was < 1% chance of the virus being recovered from the soil. Characterization of survival on wood demonstrated a 31% chance that BVDV would be recovered at one hour for MV and a 5% chance that BVDV would be recovered at one hour for PV. After eight hours, there was < 1% chance of the BVDV being recovered from wood. Characterization of survival on latex demonstrated there was a 98% chance that BVDV would be recovered at one hour for the MV and an 85% chance that BVDV would be recovered at one hour for PV. At 48 hours, there was a 20% chance that BVDV would be recovered in the MV group and < 3% in the PV group. Characterization of survival on rubber demonstrated there was an 89% chance that BVDV would be recovered at one hour for MV and a 46% chance that BVDV would be recovered at one hour for PV. At 48 hours, there was < 4% chance of survival from either group. Characterization of survival on enameled metal demonstrated there was an 89% chance that BVDV would be recovered at one hour for MV and a 46% chance that BVDV would be recovered at one hour for PV. At 48 hours post incubation, there was < 4% chance of recovering BVDV from either group. Characterization of survival on galvanized metal demonstrated there was a 22% chance that BVDV would be recovered at one hour for MV and a 3% chance that BVDV would be recovered at one hour for PV. After eight hours, there was < 1% chance of BVDV being recovered. Characterization of survival in PBS demonstrated there was a 95% chance that BVDV would be recovered at one hour for MV and a 66% chance that BVDV would be recovered at one

hour for PV. By 48 hours post incubation, there was < 8% chance of recovery from either group.

Characterization of survival in water demonstrated a 98% chance that BVDV would be recovered at one hour for MV and an 82% chance that BVDV would be recovered at one hour for PV. At 48 hours post incubation, there was a 16% chance that BVDV would be recovered in MV compared to 2% in PV.

Significance

Under the conditions of this study, a NCP, type 1b, BVDV was capable of surviving after application to various materials used in livestock production. When in the presence of mucus, BVDV was protected from degradation for longer periods of time than when not in the presence of mucus.

Diagnosis of Congenital Bovine Viral Diarrhea Infection in Beef Cow-Calf Herd from Fence-Line Contact

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Introduction

A closed herd of 76 head of Angus and Gelbvieh X commercial cows experienced a series of late gestation abortions, congenital deformities, and weak calves in replacement heifers. History included fence-line contact with a neighboring farm from day 76 to 165 after the beginning of breeding season. The neighbor grazed feeder steers purchased from livestock markets.

Materials and Methods

The herd was comprised of 65 mature cows and 11 bred heifers (case group). Calves were only vaccinated with a 7-way clostridial bacterin toxoid. On June 14, 2004, a bull was turned out with the heifers for 60 days. Heifers were combined with the cow herd and bulls in August and September. During this time, the breeding herd had fence-line contact with feeder steers that the neighbor had purchased from livestock markets. During November and December, the pregnant cattle were turned into another pasture with fence-line contact with another neighbor's cow-calf herd which were of livestock market origin. Abortions began in March, about 3 to 4 weeks prior to the expected calving time.

In the 11 bred heifers, there were two aborted fetuses, three weak calves (died 2-6 days of age), two congenital defects (spina bifida), one open heifer, and three normal calves. Myodegeneration was noted in cardiac

and tongue musculature of two calves. Liver selenium levels were evaluated by the University of Kentucky Livestock Disease Diagnostic Center Toxicology Section.

Results

Bovine viral diarrhea was diagnosed in one aborted fetus and all three weak calves by virus isolation. The three normal calves were identified as persistently infected with positive ELISA on ear notch samples. FA and MAP-leptospirosis, FA-infectious bovine rhinotracheitis, and ELISA neospora were negative.

No abortions occurred in the cows. Seven of the 54 calves born to mature cows were identified as persistently infected with BVD on ear notch samples. The University of Nebraska Veterinary Diagnostic Laboratory performed immunohistochemistry on skin samples from nine calves to verify that they were positive. One aborted fetus and one weak calf had deficient levels of selenium.

Significance

Natural infection of heifers or cows is most common source of BVD-PI animals. This was a closed herd with fence-line contact with neighbors' cattle. Heifers are most susceptible, especially in non-vaccinated herds. Pre-breeding BVD vaccination of heifers should be included in the herd health program.