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Assessment of Biosecurity Procedures to Prevent Bovine Viral Diarrhea Virus Cross Contamination

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ABSTRACT

Bovine viral diarrhea virus (BVDV) is a common virus among cattle, and there are many different strains of the virus. BVDV can cause mucosal disease in infected cattle. There are lab strains of BVDV used for testing, but there are also wild-type viruses that may develop within a herd or population. These wild-type strains can be dangerous due to cross contamination between herds. This project compares serum samples from two different herds on the basis of the antibody response to a wild-type virus isolated from a persistent infected animal in one of the herds. We tested for a possible cross contamination between a persistently infected herd and a non-persistently infected herd. Cross contamination can cause errors in data collected from the non-persistently infected herd. Serum neutralization testing was done to measure a response to a specific virus strain. Our results indicated that there was no cross contamination.

INTRODUCTION

The BVDV virus was first isolated in 1946 when it was causing depression and diarrhea in infected cattle. Some years later, in 1953, another virus named Mucosal Disease Virus was isolated that caused erosive lesions in the digestive tract of infected cattle. Soon after, due to serological testing, the two viruses were found to be the same virus.

Bovine viral diarrhea (BVDV) causes a number of diseases in cattle. It is a ss RNA virus of the genus Pestivirus and family Flaviviridae. The effects are dependent on strain, age of cattle, and immunity of herd. There are many strains consisting of cytopathic and non-cytopathic strains. It is found in low levels in most cattle development operations. Transmission typically occurs through horizontal transmission within the herd by either inhalation or contact with body fluids. Fomites, while rare, may also transmit the virus. BVDV is most serious when it infects pregnant cows. The BVDV virus can lead to abortions, premature births, or stunted calves at birth. BVDV may be present in a cow and not cause visible disease, while at other times it can cause serious diarrhea along with oral sores. The non-disease causing virus may still weaken the immune system, creating an opportunity for other infections.

Persistent infection can occur in a herd. These herds constantly have virus in their cells and constantly shed virus but disease may appear and reappear periodically. Persistence is caused when a pregnant cow becomes infected with BVDV, and the virus crosses the placenta, infects the calf, and the calf is born infected with the BVDV virus. This calf remains permanently infected and constantly shedding virus.

Many procedures go into testing serum samples for antibodies against a strain of BVDV. Virus production is performed to grow virus stock to perform additional tests. Cells are infected with the virus and virus particles are harvested from the solution. A tissue culture infectious dose 50 (TCID 50) is performed to test for the titer of the virus. Finally, serum neutralization is performed with serum samples. A serum neutralization test is used to test many samples for antibodies against a certain virus strain. Information on BVDV, can be gained on many herds by using serum neutralization tests. Also if a cow does have antibodies against a virus, a titer, which is a measure of antibody level, can be obtained from the serum neutralization tests.

The objective of this study was to test two different herds for cross contamination with a virus and by testing the antibody titer of the cattle that may have been cross contaminated.

MATERIALS AND METHODS

Three BVDV strains, type 1a Singer, type 2a A125 and a wild type 2a SD05-13414 were used. To start the study, virus was added to bovine turbinate (Bt) cells to produce virus for the study. The virus-infected solutions were then frozen and thawed multiple times; the virus supernatant was collected, placed into cryovial tubes, and frozen at -80C. Cell culture was performed to harvest Bt cells to run a TCID 50 assay. A TCID 50 was performed by placing growth media and two-fold virus stock dilutions down a row in a 12-well plate. Cells were then added to each well, incubated, and observed for cytopathic effects (CPE) after a few days. The plate was read to determine the highest dilution where the virus produced CPE, and the TCID 50 value was calculated. Finally, a serum neutralization was prepared with the virus that showed the most obvious CPE and the highest TCID 50 value. Each well was inoculated with 300 TCID 50. Growth media (minimal essential media and antibiotics), test serum, and virus stock working solution were added to each well of a 96-well plate and incubated. A backtitration was also performed in one of the plates to demonstrate how much virus was present to be neutralized by the test serum. Susceptible Bt cells were then added to the wells and incubated again for 5-7 days. The serum neutralization plate was then read for the presence of CPE to determine which, if any, serums contain antibodies against the virus. If antibodies were present, the titer of the antibody was calculated as well.

RESULTS

The presence of antibody and titer was achieved by running the serum neutralization assay. Results for both the SDSU PI herd and the SDSU non-PI herd were compared.

Columns 1 and 2 compared BVDV type 1 and BVDV type 2 antibody titers of the calves against the three test strains. The wild-type BVDV virus 05-13414 was the cytopathic virus isolated from PI 44 and was the virus tested for cross contamination into the non-PI herd.

Calves PI 31, PI 36, PI 41 and PI 44 developed antibody titers to the wild-type virus in the PI herd. This was expected since these animals were in the PI herd. The non-PI herd was negative for antibodies against the wild-type virus. This data indicated that no cross contamination occurred between the SDSU non-PI herd and the SDSU PI herd.

DISCUSSION/CONCLUSION

The purpose of this study was to test two herds for cross contamination with a wild-type virus. The two herds were less than 100 yards apart and were fed and cared for by the same personnel. Prior to bringing the non-PI herd to the facility, strict biosecurity measures were implemented to prevent cross contamination. The data indicated that there was no cross contamination between the two herds. The SDSU non-PI herd showed no antibody titer for the wild-type virus isolated from the SDSU PI herd. Even though cross contamination is very possible between herds, the implementation of biosecurity procedures can effectively prevent cross contamination.

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