

Experimental Acute BVDV Infection in White Tail Deer Fawn

J.F. Ridpath, PhD¹; C.S. Mark²; C.C.L. Chase, DVM, PhD²; J.D. Neill¹

¹NADC/ARS/USDA, Ames, IA

²South Dakota State University, Brookings, SD

Introduction

Bovine viral diarrhea viruses (BVDV) infect a number of domestic and wildlife species besides cattle. Because free ranging cervid populations are frequently in contact with domestic cattle in the US, possible transfer of BVDV between cattle and cervids has significant implications for proposed BVDV control programs. BVDV has been isolated from German roe deer, Scottish deer, white tail deer and mousedeer, but little information is available regarding clinical presentation and progression of infection in these species. Preliminary studies of experimental infection of deer with BVDV have noted seroconversion but no clinical signs. In this study we infected white tail deer fawns, negative for BVDV and antibodies against BVDV, with either a type 1 or a type 2 BVDV. The clinical progression following inoculation in these fawns was similar to that seen in BVDV infections in cattle and included fever and depletion of circulating lymphocytes.

Materials and Methods

Virus isolation, characterization and propagation

Two viruses were isolated from two different deer carcasses submitted to South Dakota State University for testing. Viruses were propagated in MDBK cell lines and characterized by phylogenetic analysis of 5' UTR sequences and monoclonal antibody binding.

Deer Fawns

Two- to four-week-old bottle-fed white tail deer fawn were purchased from a commercial breeder and tested free of antibodies against BVDV by serum neutralization and free of BVDV by virus isolation from buffy coat. Deer were co-housed by experimental group in climate controlled BL2 barns.

Experimental design

Deer were divided into three groups as follows, non-inoculated control (n=2), inoculated with BVDV1b strain (n=4) and inoculated with BVDV2 strain (n=2). Inoculated fawns received 3.5 mls 5.6 x 10⁶ tissue culture infectious dose (TCID)₅₀/ml by the oral/nasal route. Basal temperatures were recorded daily and blood samples were collected pre-inoculation and on days 3, 6, 9, 11 and 13 post-inoculation for blood count, serology and virus isolation. Serum samples were collected 30 days post inoculation.

Results

Fawns did not display overt clinical disease in that no fawn developed diarrhea or cough. However inoculated groups, but not control groups, had average basal temperature readings above 102.5°F (39.2°C) for at least six days, with some animals having readings above 104°F (40°C). On days 3 and 6 post inoculation, both inoculated groups had a greater than 40% decrease in circulating lymphocytes. No significant change was seen in circulating lymphocytes levels in the control group. A decrease in platelet numbers was observed in the BVDV2 inoculated group but not the other two groups.

Virus was isolated from both inoculated groups but not the control group. Sequencing analysis confirmed that isolated virus was the same as inoculation virus. Both inoculated groups, but not the control group, developed neutralizing serum titers against BVDV.

Significance

Previous studies of acute BVDV infection in cervids reported virus replication but no overt clinical disease. However, in a wildlife species such as white tail deer, the "fight or flight" response elicited by the presence of caretakers may override clinical signs, such as depression. Frequent monitoring of blood counts and basal temperature in this study revealed a significant and prolonged rise in temperature accompanied by a pronounced decrease in circulating lymphocytes. In cattle, BVDV infections are characterized by a biphasic fever beginning about day 3, peaking about day 6 and resolving by day 12 post-infection. Viremia in cattle usually occurs between days 3 and 11 post-inoculation, with a lymphocyte drop that is most pronounced about day 6. Thus, the course of infection observed in fawn in this study was very similar to that reported for cattle infected with BVDV. In cattle it is assumed that the lymphocyte drop is associated with the immune suppression commonly observed with BVDV infections. Further research needs to be done to confirm if immune suppression also occurs in cervids. Because the acute infection appears so similar between cervids and cattle, the logical question is whether cervids develop persistent infections similar to cattle. Experiments are now on-going to answer that question.