Diagnosis and Control of Viral Diseases of Reproductive Importance

Infectious Bovine Rhinotracheitis and Bovine Viral Diarrhea

Benjamin W. Newcomer, DVM, PhD[a], Daniel Givens, DVM, PhD[b,*]

KEYWORDS

• Biosecurity • Bovine herpesvirus • Bovine viral diarrhea virus • Surveillance • Testing • Vaccination

KEY POINTS

- Both bovine viral diarrhea (BVDV) virus and bovine herpesvirus 1 can have significant negative reproductive impacts on cattle health.
- Vaccination is the primary control method for the viral pathogens in US cattle herds.
- Polyvalent, modified-live vaccines are recommended to provide optimal protection against various viral field strains.
- Of particular importance to BVDV control is the limitation of contacts of pregnant cattle with potential viral reservoirs during the critical first 125 days of gestation.

Viral infection and disease can have significant negative impacts on the reproductive efficiency of cattle herds in both the beef and the dairy industries. Consequences of infection range from abortion outbreaks that can affect a large proportion of the pregnant herd to more subtle syndromes (eg, impaired conception, early embryonic death) that may go unnoticed or undiagnosed. Diagnostic tests must be used in a way that conforms to the overall biosecurity program of the operation, and when applied correctly, should be viewed as an economic asset and not a liability. Control programs should be designed and implemented to prevent introduction and/or spread of the viral pathogens with particular attention to the periods in the

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[a] Department of Pathobiology, College of Veterinary Medicine, Auburn University, 127 Sugg Laboratory, Auburn, AL 36849-5516, USA; [b] Office of Academic Affairs, College of Veterinary Medicine, Auburn University, 217 Veterinary Education Center, Auburn, AL 36849-5536, USA
* Corresponding author.
E-mail address: givenmd@auburn.edu

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production cycle when cattle are most susceptible to the consequences of disease. Such schemes must be implemented in harmony with the variance in management schemes and production goals of individual producers. This review focuses on (a) the potential reproductive consequences of bovine viral diarrhea (BVD) and infectious bovine rhinotracheitis (IBR); (b) surveillance schemes to assess the level of infection at the herd level and diagnostic assays for detection of infection in the individual; and (c) vaccination and biosecurity programs to prevent or mitigate the effects of infection in replacement heifers, the mature herd, and animals newly introduced to the farm.

REPRODUCTIVE CONSEQUENCES OF INFECTION WITH BOVINE VIRAL DIARRHEA VIRUS

Although capable of manifesting in any number of bodily systems, the reproductive consequences of BVD are the most costly on dairies and cow-calf operations.[1] Cattle that are infected shortly before the breeding period have reduced conception rates.[2,3] Decreased conception rates may result from impairment of fertilization or early embryonic death but may be, at least in part, mediated by alterations in ovarian function. Transient infection with bovine viral diarrhea virus (BVDV) can result in oophoritis and subsequent ovarian dysfunction,[4] resulting in impaired fertility and repeat breeder syndrome.

Viremia subsequent to infection of a naïve, pregnant animal allows the virus to readily cross the placenta of pregnant animals and infect the growing fetus; the effect on the growing fetus depends largely on the stage of gestation at which the infection occurs.[5] A naïve cow infected during the first month and a half of gestation may suffer early embryonic death, due to endometrial inflammation resulting from the viral infection or direct viral effects on the developing embryo. Infection between 3 and 5 months of gestation, while the fetus is undergoing the final stages of organogenesis, is associated with a variety of congenital defects, most commonly involving the central nervous system. Cerebellar hypoplasia is the most notable developmental defect, but other common defects include hydranencephaly, microphthalmia, hypotrichosis, and brachygnathism. If infection occurs after the completion of organogenesis and the development of fetal immunocompetence, the calf may mount a protective immune response as demonstrated by a precolostral antibody titer to BVDV. However, infection during this period can result in abortion of the pregnancy or, less commonly, the birth of weak calves.

The most important consequence of intrauterine infection is the creation of the persistently infected (PI) animal. In utero exposure to noncytopathic strains of BVDV before development of fetal immunocompetence (generally before 125 days of gestation) can result in a calf that is PI with the virus.[6] PI calves are often weak at birth, and most will die before 1 year of age. However, others may not show signs of disease but continuously shed virus and are epidemiologically important due to efficient transmission of BVDV. Superinfection of PI calves with homologous cytopathic strains of BVDV may result in mucosal disease, which is almost invariably fatal. Calves born to PI cows or heifers will consistently be PI themselves. Thus, preventing the creation of PI animals is essential to control of the virus.

Effects of infection in the bull are less noticeable than in female cows. Infectious virus is shed in the semen of transiently infected or PI bulls.[7] Although shed in lower levels, semen from transiently infected bulls, as well as from PI bulls, is capable of infecting naïve cattle, resulting in seroconversion and the potential birth of PI calves.[8,9] Less commonly, persistent testicular infection has been reported; such bulls consistently shed high amounts of live virus in the semen despite high serum antibody titers