

Bovine Viral Diarrhea Virus–Associated Disease in Feedlot Cattle

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KEYWORDS

- Bovine viral diarrhea virus • Feedlot cattle • Immunosuppression • Vaccination
- Screening test

KEY POINTS

- Bovine viral diarrhea virus (BVDv) has immunosuppressive and direct effects that interact with other risk factors to impact the likelihood and severity of bovine respiratory disease complex (BRDC) in feedlot cattle.
- Vaccination of feedlot cattle against BVDv antigens is commonly practiced in North American feedlots and a relatively small amount of research data support this intervention as being effective to reduce the likelihood or severity of BRDC.
- Several tests are available to determine if cattle are persistently infected (PI) with BVDv and these tests have high sensitivity and specificity.
- Because of the low prevalence of feedlot cattle PI with BVDv, many positive test results are false-positive.
- Selection of the optimum strategy to use available tests for PI status depends on having an accurate estimate of the cost of PI cattle to feedlot production.

INTRODUCTION

Bovine viral diarrhea virus (BVDv) refers to a heterogeneous group of viruses that belong to 2 different species, BVDv1 and BVDv2, within the pestivirus genus of the Flavivirus family.¹ Bovine viral diarrhea viruses are further subclassified as cytopathic and

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noncytopathic based on their activity in cultured epithelial cells, with noncytopathic BVDv predominating in nature.¹ These viruses are associated with a number of feedlot cattle diseases; primarily bovine respiratory disease complex (BRDC) and to a lesser frequency, digestive tract disease.

BOVINE VIRAL DIARRHEA VIRUS AND BOVINE RESPIRATORY DISEASE COMPLEX

BRDC is an important disease of cattle and is causally associated with a number of identified and suspected risk factors, including infection with BVDv.²⁻⁴ Although, BVDv alone (uncomplicated by co-infection or serial-infection with other agents) has been demonstrated to cause respiratory infection and signs of clinical BRDC in experimental challenge studies,⁵⁻⁷ reviews of numerous studies have concluded that BVDv association with BRDC is most importantly due to suppression of the immune system and synergism with other pathogens.⁸⁻¹⁰

IMMUNOSUPPRESSION ASSOCIATED WITH BOVINE VIRAL DIARRHEA VIRUS INFECTION

Brakenbury and colleagues,⁷ summarized evidence that infection with BVDv results in immunosuppression in the absence of clinical signs of primary BVDv-induced disease. Experimental studies found that acute infections with BVDv enhanced susceptibility to infection with bovine herpes virus 1,¹¹ and case reports have linked concurrent infections with other BRDC-associated pathogens with BVDv infections.¹² Subsequent experimental studies showed healthy cattle exposed to BVDv responded differently to a challenge with *Mannheimia haemolytica* than calves not previously exposed to BVDv.¹³

Ridpath⁸ reviewed available literature and concluded that the immunosuppression that accompanies acute BVDv infections results from a combination of outright lymphoid cell death^{14,15} and reduced function in remaining lymphoid cells.¹⁰ Although the mechanism remains undefined, infection with either high- or low-virulence BVDv results in the reduction of circulating lymphocytes¹⁴⁻¹⁶ and the depletion of lymphoid tissue.^{17,18} The difference in pathology between high-virulence and low-virulence BVDv strains is in the extent of cell death or loss, with reduction of circulating lymphocytes and lymphoid depletion being significantly higher after infection with highly virulent BVDv.⁸

Peterhans and colleagues⁹ and Chase and colleagues¹⁰ summarized the literature relating to the immune response to BVDv and reported that in addition to reducing lymphoid cell numbers, BVDv infections impair the function of cells associated with both the acquired and innate immune systems. The interactions resulting in immune suppression are complex and components of the innate immune response that are reported to be suppressed in response to BVDv infection include interferon production, phagocytosis, chemotaxis, and microbicidal killing. On the acquired immune side, changes such as downregulation of major histocompatibility complex II and interleukin-2 that suppress T-helper cell response and apoptosis of T and B cells in lymphoid tissue are critical immunosuppressive mechanisms.¹⁰

PERSISTENTLY INFECTED CATTLE AS THE MOST IMPORTANT RESERVOIR FOR BOVINE VIRAL DIARRHEA VIRUS

Creation of Cattle Persistently Infected with Bovine Viral Diarrhea Virus

Several pathogens associated with important diseases of cattle are able to establish a persistently infected (PI) state, but the method by which BVDv creates a PI state is

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