TECHTALK
Scientific Update from Elanco Animal Health

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Bovine Viral Diarrhea (BVD) in Beef Cattle

Studies show subtype 1b has emerged as the predominant BVD viral strain

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Overview — highly contagious, immune-suppressing and costly

The BVD virus causes a highly complex immune-suppressing disease often referred to as the most costly viral disease in U.S. cattle herds.[1]

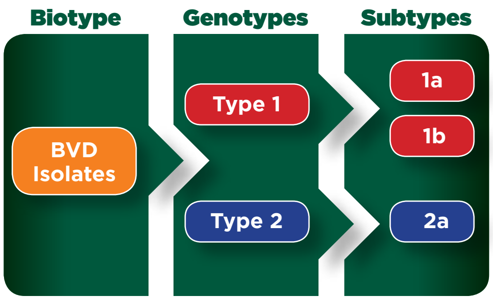
Found most often in cattle younger than 2 years of age, BVD affects multiple body systems of the animal and decreases the immune system's ability to fight infections.[1] As a result, feedyard and stocker producers face higher production costs due to poor feed conversion and higher mortality.[2]

The primary source of the disease is exposure to persistently infected (PI) animals — cattle that are infected and shed large amounts of the virus throughout their lives. While the prevalence of BVD can vary, research shows that exposing a general population of feedlot cattle to PI animals costs $67.49/hd due to performance losses and fatalities.[2]

To effectively control BVD, it's important to understand which strains of the disease are most common and how their predominance has changed over time. According to a 20-year analysis of diagnostic samples that tested positive for one or more of the three primary BVD viral strains, the predominance of subtype 1b has been increasing (41% to 61%).[3] During this same period, subtype 1a has decreased, yet the incidence of BVD has not been reduced.[3] Additional research also shows that the most prevalent subtype in PI calves is 1b (78%).[4]

These findings indicate the practice of using current modified-live cattle vaccines — which include 1a and 2, but not 1b — has not provided adequate protection. Julia Ridpath, Ph.D., U.S. Department of Agriculture (USDA), Agricultural Research Service and leading BVD authority, suggests control of BVD might be improved by the use of vaccines that contain 1b antigens in addition to 1a antigens.[3]

BVD background



The BVD virus is an RNA virus. Unlike DNA viruses, RNA viruses have a higher mutation rate and, therefore, have an increased potential to create additional strains.[5] While BVD virus genotypes 1 and 2 are diagnosed worldwide, the common subtypes of each genotype can vary considerably by region.[6] The most common disease-causing strains found in the United States are subtypes 1a, 1b and 2a.[3]

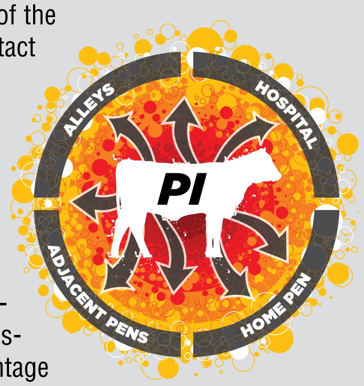
Cattle with BVD shed this highly contagious virus in body fluids such as nasal secretions, saliva, blood, urine, feces, semen and placental fluids.[7] This makes it easy for horizontal transmission — not only directly from animal to animal, but also indirectly through contact with contaminated surfaces such as water and feed bunks. Vertical transmission occurs from cow to calf, with PI calves infected through the placenta between months one and four of gestation.

When vertical transmission results in a PI calf, that animal is infected for life. Its immune system does not recognize the BVD virus as foreign, so it allows the virus to grow and thrive. This means PI calves shed high levels of the BVD virus their entire lives. While most PI calves do not survive to adulthood, there are others that live for years and may show no clinical signs of disease. Regardless of how long they live, PI cattle are highly capable of spreading BVD throughout the ranch, stocker operation, backgrounding yard or feedlot. That's why developing a protocol to identify and manage these reservoirs of BVD virus is critical.

PI calf exposure — low incidence, high impact

Just one PI calf can create an exponential spread of BVD, leading to clinical disease and costly losses.

In a study of 21,743 feedlot calves,[4] 86 were identified as PI. While this number seems low, PI calves were found in 74 of the 240 pens. This means cattle in 31% percent of the feedyard's pens were in direct contact with PI calves that were actively shedding the virus. But this is not the full extent of their impact. Cattle in adjacent pens also are exposed to PI cattle. And, since PI cattle are more likely to be pulled for treatment,[11] they come in contact with animals along alleyways and in the hospital pen, exposing an exponentially greater percentage of the yard's population.



When BVD is transmitted horizontally, otherwise healthy animals can develop a transient BVD infection. Virus transmission occurs from exposure not just to PI cattle, but also to other transiently infected (TI) cattle.

Predominance of BVD viral strains

Because RNA viruses are more susceptible to mutation, it is important to monitor the incidence of BVD viral strains to help control the disease. To understand which strain(s) are predominant at a given time, scientists review general data from diagnostic laboratories and look at the prevalence in infected animals.

Predominant BVD viral strains among PI calves:

- In a surveillance study conducted from June 2012 to February 2013, among 515 samples tested from seven laboratories in seven states, subtype 1b was most predominant at a prevalence rate of 73%, followed by 2a at 17%.[8]
- PI calves identified in a feedyard study were tested to determine the incidence of BVD viral strains. Subtype 1b was the predominant strain, found in 78% of the cases.[4]

78% **78% of PI calves are infected with 1b**[4]

Predominant BVD viral strains in diagnostic samples:

- A 20-year analysis of diagnostic samples testing positive for BVD shows there has been a shift in predominance of BVD viral strains in the United States. In 1988, subtype 1a was predominant at 51%. Twenty years later, 1a ranked third at 18%, while subtype 1b increased in predominance from 41% to 61%. Although the proportion of BVD virus subtype 1a has decreased during this time, the incidence of BVD has not gone down.[3]
- Another U.S. study looked at the prevalence of BVD infections in two groups of stocker calves with acute respiratory disease. It found that BVD was present and, in numerous instances, appeared to contribute to bovine respiratory disease (BRD). The predominant subtype was 1b at 86%.[9]

Impact of BVD

BVD is a multisystem problem for cattle and can display a wide variety of clinical signs.

Respiratory system — BVD infections are associated with BRD, both directly and indirectly. In fact, the BVD virus is the most often isolated virus in BRD outbreaks.[10]

A study looking at 2,000 cattle entering a feedlot reaffirmed that even though relatively few incoming cattle are PI-positive, they can cause profound problems. The researchers found that PI cattle are more likely to need BRD treatment, become chronically ill or die. Beyond that, cattle exposed to these PI calves experience a significant increase in respiratory disease (43%).[11]

43% **Calves in the same pen or adjacent pen to a PI calf are 43% more likely to require BRD treatment**[11]

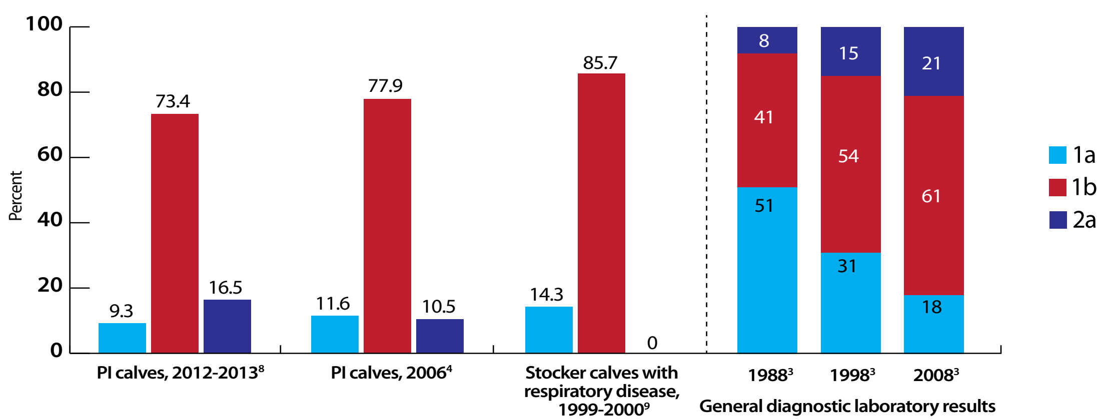
Immune-suppressing — Another important effect is how BVD decreases the system's ability to fight infections, allowing an open door for respiratory and other diseases. For example, research shows that experimentally induced diseases associated with infectious bovine rhinotracheitis (IBR) or *Mannheimia haemolytica* were more severe if animals were concurrently challenged with the BVD virus.[12]

Digestive system — BVD can cause mucosal ulcerations throughout the digestive tract, making it difficult for cattle to absorb nutrients. This can lead to diarrhea, with or without blood, and anorexia.[6]

Reproductive system — BVD manifests itself with low conception rates, often caused by early embryonic death, abortions and stillbirths.[6]

Mucosal disease — In PI cattle, BVD also can lead to mucosal disease, a highly fatal disease.[6]

Figure 1. Research summary – emergence of BVD virus subtype 1b



The economics of BVD

The most definitive study quantifying the economic effects of feedlot cattle being exposed to PI animals evaluated 21,743 high-risk calves from the Southeastern U.S.[2] Researchers found 0.4% of incoming cattle were PI-positive — a number similar to the incidence in other studies. Sixty-two percent of the pens allowed direct exposure to a PI animal in either the same pen or an adjacent pen.

The cost of exposing calves to BVD in the feedyard was $67.49/hd. The vast majority of this amount, $58.83, was due to the loss in performance, primarily decreased efficiency. The remainder ($8.66) reflected an increase in mortality. The bottom line is that, while few in number, PI calves can have an economically devastating effect in feedlot cattle.

Figure 2: The per-head cost of exposing feedyard cattle to PI calves[2]

Because of BVD's immune-suppressing nature and its close association to BRD, producers should also take into consideration the cost of respiratory disease, both clinical and subclinical:

- BRD accounts for 75% of feedlot morbidity and 50% to 75% of mortality,[13,14,15] costing the industry an estimated $800 to $900 million annually due to treatment costs, death loss and reduced feed efficiency[16]
- A significant number of animals are never diagnosed with BRD, but do, in fact, suffer from some degree of respiratory disease. In a study[17] identifying lung lesions at harvest, 65% of the cattle were untreated for BRD, yet 68% of the untreated calves had pulmonary lesions at harvest. Cattle with lung lesions at harvest had a 0.17-lb reduction in ADG over the feeding period

Preventing BVD through vaccination

Although not the only component of a BVD-control program, vaccinating calves is an important part of a biosecurity plan to manage this highly contagious disease. Vaccine administration should be planned to enable a strategic protective immune response throughout the animal's life.

Most commonly used cattle vaccines include BVD viral strains 1a and 2. A review of the incidence of BVD viral strains over time (see Figure 1) suggests that ongoing vaccination programs have effectively lessened the predominance of 1a in the United States. At the same time, subtype 1b has increased in predominance, suggesting current modified-live subtype 1a vaccines might not cross-protect calves adequately from subtype 1b infections. It is generally recognized that the more similar a vaccine is to the disease-causing form of the organism, the better the immune response.[18] Therefore, while it's possible 1a vaccines can provide some cross-protection for subtype 1b, there is a need for new solutions to help manage today's predominant strain of BVD.[3,4]

New vaccine innovation includes all three BVD antigens

Viralign™ 6 is the first USDA-licensed combination modified-live vaccine to provide targeted protection against 1b, the most predominant BVD virus subtype. Viralign 6 also includes BVD antigens 1a and 2, and protects against bovine respiratory syncytial virus (BRSV), IBR and parainfluenza$_3$ (PI$_3$) virus. For feedyard and stocker producers, this vaccine represents more complete protection and, ultimately, a calf that is better able to fight off profit-robbing diseases, such as BRD, and minimize their economic impact.

Key points

- BVD is a complex immune-suppressing disease that costs feedyards $67.49/hd when cattle are exposed to a BVD PI animal[2]
- Most commonly used combination vaccines rely on cross-protection from 1a and 2 to protect against 1b, which may not provide adequate protection given the emergence of 1b
    - Among diagnostic samples collected during a 20-year period, 1b has increased in predominance from 41% to 61%[3]
    - Subtype 1b is also the most predominant strain (78%) among PI cattle, the primary shedders of the highly contagious BVD virus[4]
- Viralign 6 provides targeted protection against subtype 1b, the most prominent BVD virus subtype

> **"The more similar a vaccine is to the disease-causing form of the organism, the better the immune response to the vaccine."**
>
> Center for Disease Control, *Principles of Vaccination*

The label contains complete use information, including cautions and warnings. Always read, understand and follow the label and use directions.

Precautions: Do not vaccinate pregnant cows or calves nursing pregnant cows, since abortions may occur. Do not vaccinate within 21 days of slaughter.

For vaccination of healthy cattle five months of age or older.
Dose: 2 mL subcutaneous in the side of neck. See insert for full instructions.

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