WHAT IS BOVINE VIRAL DIARRHEA VIRUS (BVDV)?

Bovine Viral Diarrhea Virus (BVDV) is one of the pestiviruses known to infect ruminants, camelids, and swine. For bovine producers, the virus causes economic losses through decreased weight gains, decreased milk production, reproductive losses, and death. The BVDV is classified as Type I and Type II, and both BVDV types are detected by current test methods. This type of BVDV does not predict disease severity; however, there are two categories of BVDV infection based on severity and progression of disease.

Despite the name, many animals with BVDV do not have diarrhea. Other manifestations of the virus include subclinical infections, immunosuppression, abortions, congenital defects, persistent infection, and mucosal disease. The majority of infected cows are either subclinically ill (do not appear sick) or have only mild clinical signs such as low grade fever and diarrhea. Because BVDV suppresses the immune system, some animals will become ill with other infections, usually pneumonia; other animals will display classic signs of BVDV with fever, discharge from the nose and eyes, erosions of the muzzle and in the mouth, and severe diarrhea; others may have severe hemorrhagic (bloody) diarrhea and die. Severity of illness is influenced by the age of the animal and its immunological and physiological status, and the particular strain of the virus involved.

The most important aspect of BVDV is its effect on the developing fetus. BVDV can cause abortions at any stage of gestation – from early embryo loss to stillbirths at term. Even a subclinically infected cow can abort, and abortions may occur up to several months after exposure to the virus. A unique feature of the BVDV is its ability to produce a persistently infected (PI) calf, which occurs when the cow is exposed to the virus at a critical phase of her gestation (approximately 40-120 days) and does not abort. The developing fetus is not immunocompetent at that stage of development, so it becomes immune-tolerant to the virus (does not recognize the virus as foreign). Therefore, the calf is unable to evoke an immune response to rid itself of the virus, and once born, is a permanent carrier and sheds large amounts of the virus in body secretions, including: tears, nasal discharge, saliva, urine, and feces. PI calves are the major source of the spread of BVDV. PI calves can shed several billion viral particles each day, which is about a thousand times more than what is shed by a transiently infected non-PI animal.
Testing for BVDV is complicated, with different tests being used in different situations. Having antibodies (blood test) to BVDV shows that the animal was exposed to the virus (from a clinical or subclinical infection, or from immunization), but it is unknown how long antibodies are detectable after exposure. Any positive BVDV test results, considered in conjunction with the herd history, may suggest the need for further testing within the herd. For BVDV herd screening, every animal in the herd should be evaluated for the virus in some way, either by PCR, Antigen capture ELISA, or Immunohistochemistry.

<table>
<thead>
<tr>
<th>Duration of the disease</th>
<th>Transient (acute) infection (TI)</th>
<th>Persistent (chronic) infection (PI)</th>
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<td>Short-term infection, usually weeks.</td>
<td>Life-long infection.</td>
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When the animal acquired the virus

- Acquired after birth. (N.B.: Usually, only fetal infection results in BVD-PI. The only way to be a PI animal is to be born as a PI animal)
- Acquired in utero. Thus, only fetal infection results in BVD-PI.
- <5% of BVDV infections are TI
- >95% of BVDV infections are PI

Clearance of the infection

- TI cattle become immune and clear the virus
- PI cattle never become immune and carry the virus for life.

Source of the virus

- TI animals are a minor source of the virus spread in a herd
- PI cattle are the major source of the virus spread in a herd.

How PI calves are born

- Over 90% of BVDV-PI calves are born from normal dams (no prior BVDV exposure) which were likely TI animals.
- PI animals have a low likelihood of surviving but always give birth to PI calves.

DIFFERENTIATING PERSISTENT INFECTION (PI) AND TRANSIENT INFECTION (TI)

PI animals will not have antibodies, unless they were tested as newborns soon after ingesting their mother’s antibody-containing colostrum. To accurately detect a PI animal, testing for the virus must be done twice, 3-4 weeks apart, with both results being positive for the virus.

Even the PCR test cannot distinguish between a transiently (acutely) infected animal and a PI animal. PCR positive animals must also be retested 3-4 weeks after the initial testing. As with other BVDV testing, acutely infected animals that have recovered will be virus negative, while PI animals will be positive on the second test.

BVDV TESTING FOR THE DAIRY INDUSTRY:

Bulk tank milk testing: Many PI animals die before 2 years of age, but some may survive longer. Bulk tank milk samples can be used to identify PI animals that become part of a milking group. A sample of 200 mL of milk from a well-stirred bulk tank may be submitted for testing. The sample should represent a pool of not more than 400 animals. Keep the milk chilled - DO NOT FREEZE.

- If the test is negative, then individual animals need not be tested.
- If the test is positive, the milk should be retested in 3-4 weeks to rule out acute infection.
- If the bulk milk sample is positive a second time, evaluate animals individually.

To decrease the cost (number of individually tested animals), initially test only first-lactation animals, removing any positives, followed by testing another bulk milk sample. If this is negative, remaining 2nd and 3rd lactation animals that contributed to the bulk milk sample do not need to be tested. An alternative strategy is to milk half the herd, take a milk sample, milk the remaining half of the herd, and take a second sample. If only the second sample is positive, then individually only test the animals that contributed to the second milk sample.

ADDITIONAL RECOMMENDATIONS:

- PCR detects BVDV-1, BVDV-2, Border Disease Virus (BDV), and HoBi-like pestiviruses.

INSTRUCTIONS FOR SUBMISSION

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<th>Sample Type</th>
<th>Purpose</th>
<th>Cost</th>
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<td>PCR for Virus Detection</td>
<td>EDTA blood, serum, plasma, tissues, fresh ear notches or milk</td>
<td>Primary test for both PI and acutely infected animals. The test is sensitive and cost-effective.</td>
<td>$30.00 Pooled PCR (BADDL can pool up to 25 ear notches and up to 50 serum samples in one test)</td>
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<td>Antigen Capture ELISA for Virus Detection</td>
<td>Fresh ear notches and serum</td>
<td>Usually detects PI animals. It may miss acutely infected animals. If using serum, collect from precolostral calves or calves older than 3 months of age.</td>
<td>1-5 samples: $4.50/test 6-15 samples: $3.50/test &gt;15 samples: $3.00/test Samples will NOT be pooled for the ELISA test</td>
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<td>Fixed tissue samples</td>
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How to Manage New Animals Tested from BVDV during isolation

- If the initial test is negative (BVDV not detected) = no BVDV infection. After 30 days of isolation and no evidence of disease, these animals can be introduced into the established herd.
- If the initial test is positive (BVDV detected) = persistent OR transient BVDV infection is suspected. Keep the new animals in isolation until retested in 3-4 weeks. If the retest is negative, the initial result was most likely due to a transient infection. If the retest is positive, a persistent infection is likely and culling of PI animals is recommended.

A negative-tested dam can be returned to the herd, but it is recommended that she be isolated just before delivery until the newborn is tested with PCR.

BVDV IN ALPACAS:

Bovine Viral Diarrhea Virus (BVDV) can cause abortions and persistent infection in alpacas. If an alpaca is exposed to BVDV during early pregnancy, she can produce a persistently infected (PI) cria who sheds large amounts of virus for life and is the major source of the spread of BVDV. Aborted or stillborn fetuses and unusually low birth weight or poor doing cria should be tested specifically for BVDV. On postmortem exams, there are usually no pathological changes to suggest BVDV. This is why specific testing is important. In addition, any pregnant females who may have been exposed to BVDV during their pregnancy should have their cria tested for BVDV soon after birth using a blood test.

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