

# BOVINE VIRAL DIARRHEA (BVD)

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**B**ovine Viral Diarrhea (BVD) is a very common viral disease of cattle, sheep and other even-toed ungulates, caused by Bovine Viral Diarrhea Virus (BVDV). BVD has been long considered a disease of the respiratory, gastrointestinal and reproductive organ but it is now believed to cause primarily reproductive symptoms, with lesser effects on the other organ systems.

Acute BVDV infection is often an inapparent to mild disease of high morbidity (number of animals affected) and low mortality (number of animals dead from the disease). It is characterized by high fever of greater than 104°, depression, decreased milk production, temporary inappetence, rapid breathing, runny nose, runny eyes and diarrhea. Clinical signs are usually seen 6-12 days after infection and may last from 1-3 days. Recovery is usually rapid and uneventful. There have been cases of severe clinical disease caused by some isolates of BVDV Type 2. This variant is characterized by very high fever of over 107°, ulcers found in the mouth, eruptive lesions along the coronary band of the hoof and in the interdigital cleft (area between the toes), diarrhea, dehydration, leukopenia (low white blood cell count) and thrombocytopenia (low blood platelet count). In cattle with thrombocytopenia, hemorrhages may be seen anywhere on the mucous membranes, including the lining of the eyelids, mouth and vulva, as well as on the whites of the eyes and third eyelid. Prolonged bleeding may occur from injection sites. Necropsy (autopsy) results may include swollen hemorrhagic lymph nodes, particularly of the intestinal tract, erosions and ulcers of the stomach and intestines, hemorrhage on the surface of the viscera (abdominal organs) and depletion of lymph tissue found on histopathology (microscopic evaluation of organs). This variant causes duration of disease between 3-7 days, with high morbidity and moderate mortality. While rare, it is not the relatively benign syndrome usually caused by acute BVDV.

BVDV causes its most devastating effects on the reproductive organs. In pregnant cattle, BVDV can cross the placental barrier and infect the fetus. This can affect the fetus in a number of ways, depending upon the stage of fetal development. Infection close to breeding can result in reduced conception rates. Infection during the first 4 months of pregnancy can lead to fetal resorption, abortion, growth retardation or persistent infection. Congenital malformations of the eyes and central nervous system may result from infections between 4-6 months of gestation. Other consequences of

fetal infection can include fetal mummification, premature birth, stillbirth and weak calves.

Persistent infection (PI) is an extremely important possible consequence of fetal infection with noncytopathic BVDV. (BVDV can be classified as either cytopathic or noncytopathic, a distinction that is made in the laboratory, and is important from a practical standpoint only because of a virus' ability to induce a persistently infected state in the fetus. While cytopathic strains of BVDV are found in nature, they are incapable of causing PI calves.) PI animals are infected at such an early stage in development (between 30 and 125 days of gestation) that their immune system literally grows up with the virus and the immune system does not recognize the virus as being foreign. The PI animal will have BVDV reproducing in its body uncontrolled and many times the animal itself may appear relatively unaffected by the virus. This animal will shed BVDV in all its body secretions, including nasal mucous, saliva, urine, manure and semen. This shedding of virus occurs uncontained by the natural defenses found in other healthy animals and large numbers of virus particles are shed virtually all the time. PI calves may appear perfectly healthy and normal in size or may be stunted and poor doers, prone to respiratory and gastrointestinal problems; 50% of PI animals will die before 12 months of age and only 10% survive past 2 years. ***You cannot be sure of an animal's status regarding BVDV, unless it is specifically tested for the presence of the virus in its body.*** Appearance can be very deceiving. If a PI cow carries a calf to term, that calf will also be persistently infected.

Mucosal Disease is an infrequent, highly fatal acute or chronic form of BVD that only affects the persistently infected animal. Mucosal Disease occurs when a PI animal is superinfected with a cytopathic strain of BVDV. The origin of the cytopathic strain is usually a mutation from the noncytopathic strain already infecting the PI animal, but can be from an outside source, such as another PI animal, an acutely infected animal or even a modified live virus vaccine for BVD. (MLV BVD vaccines are made from cytopathic strains of virus that cannot produce PI calves, but are capable of producing other reproductive symptoms seen in natural infection if given to susceptible cattle and can induce Mucosal Disease in PI animals.) Acute Mucosal Disease results in fever, leukopenia, dysentery, inappetence, dehydration, severe ulcerative lesion throughout the intestinal tract, with extensive necrosis (death) of lymph tissue of the intestines. Chronic Mucosal Disease may last

several weeks to months and while less severe than acute Mucosal Disease, is just as fatal. Intermittent diarrhea and wasting is common, with inflammation around the coronary band and in the interdigital cleft leading to chronic lameness.

Diagnosis of BVD can be tentatively made from history and clinical signs. Laboratory confirmation can include methods to detect antibody against the virus or the presence of the virus itself. Because BVDV is so common in this country, a single determination of antibody titer is seldom helpful in determining acute disease. Two blood samples taken at least 2 weeks apart with at least a 4-fold increase in antibody levels is necessary to verify recent infection. Isolation of the virus from virtually any body part or secretion confirms active infection. Identification of PI cattle requires detection of actual virus in at least 2 specimens obtained at least 3 weeks apart.

Treatment of BVD is limited to supportive therapy only. Acute disease in an otherwise uncompromised patient is usually mild and self-limiting. Antibiotics may be used in more severe cases to treat or prevent secondary bacterial infections. Painkillers, IV fluids and anti-inflammatory drugs may be part of the arsenal of treatments used in more severely affected animals.

Control is based on a combination of sound biosecurity measures, vaccination and ***detection and elimination of cattle persistently infected with the virus.*** Replacement cattle should be tested for PI status. Quarantine with physical separation from the resident herd for 2-4 weeks should be considered and vaccination for BVD should be performed prior to such a new animal being introduced into the herd. If vaccination of embryo donors or recipients is necessary, it should be done at least one heat cycle before ET is performed. Because the virus is found in semen, herd bulls and semen donors should be screened for PI status.

Persistently infected animals receive the bulk of the blame for the spread and maintenance of BVD in a herd. Until the entire herd has been exposed and developed immunity, either through natural disease or vaccination, BVD will circulate and cause some degree of disease. Every healthy calf born on a farm will be BVD naïve and require exposure to develop immunity. Ideally, this exposure will be from vaccination rather than actual disease. The important thing to remember is that while BVD is generally a mild disease, it can have devastating effects on the production level in a given herd. Abortion storms, greatly extended calving seasons, increased cull rates due to open cattle are all likely

scenarios in the face of an ongoing BVD problem. While the individual animals may be only mildly affected, the economic effect on the entire operation can be horrific.

Characteristics of herds at high risk for BVD include those with recent expansions, untested additions, no vaccination program and frequent cattle movement. Indicators of disease may include poor reproductive performance, abortions and unthrifty calves, and lingering respiratory problems. Vaccination for BVD greatly aids but does not entirely eliminate risk from this disease. Because of continually evolving viral strains, immunity may be only partial. Of course, a main source of these evolving strains can be the PI animal itself. Acutely (transiently) infected cattle will shed virus for about 4-10 days, while the PI animal will shed virus for life. The prolonged, indefinite viral replication taking place in the PI animal is the perfect environment for the development of mutations. The PI animal is also very efficient in spreading disease; less than 1 hour of contact with a PI animal can transmit the virus. Acutely, transiently infected cattle are not nearly as efficient at transmitting the virus. The virus remains viable in the environment for less than 2 weeks so that transmission can occur through contaminated equipment or reused and unsterilized medical supplies such as needles or scalpels.

Proper vaccination can help to protect against BVD. Cows and heifers need to be protected especially well during their first trimester of pregnancy, in an attempt to prevent the birth of PI calves. Vaccinating females with a modified live virus vaccine (MLV) for BVD a few weeks before breeding is seen by many as the best way to protect the developing fetus. Older MLV vaccines for BVD could not be given to pregnant cows but many of the newer products can be administered to pregnant cattle if they have been properly vaccinated as calves. As always, carefully read and follow label directions on the vaccine bottle you have chosen. There is always a risk of abortion if any MLV BVD vaccine is administered to a naïve (no previous exposure to BVDV, either naturally or by vaccination) pregnant heifer or cow. Killed virus vaccines are not considered as potent, always require an initial booster 2-4 weeks apart, and probably should be repeated every 6 months to maximize protection. The advantage to killed products is that they are

safe in pregnant cattle. (Remember that giving only one killed virus vaccination initially, and not performing a booster as recommended give virtually no protection against disease.) Cross protection between variants is inconsistent; no vaccine offers 100% protection. Protection between very similar strains is probably in the 85-95% range, where it may be reduced to 50-90% effectiveness with strains that are antigenically more removed from each other, especially related to reproductive efficiency. ***Vaccination alone is not enough to be completely effective in BVDV control.***

Testing cattle to determine PI status is relatively simple for the producer. By definition, the PI animal has virus in its tissue from birth and will always have virus present in its tissue. Hence, any test that detects the presence of the actual virus is an adequate test for PI. This can include virus isolation from a blood sample, antigen capture ELISA (Enzyme-linked Immuno-Sorbent Assay) on blood or skin, PCR (polymerase chain reaction – a method used to amplify and detect viral DNA or RNA) on either blood or skin, or IHC (immunohistochemistry) on skin. One important caveat to testing for the presence of BVDV is that MLV vaccines can cause a positive test, as can acute, transient infection. Samples should not be taken within 2-3 weeks of vaccination using live virus BVD vaccines, or within 3 weeks of active disease (if known). Any positive animal should be isolated and retested 3-4 weeks later. By definition, PI animals will retest positive, while transiently infected cattle will have mounted an immune response and should have eliminated the virus from their system in that length of time. Once you have a negative test, the results can follow the animal for life. By definition again, a persistently infected animal will always be positive for BVDV, so that a negative test means the animal is not PI. A negative test does not mean that the animal is immune from disease however. It only means that the animal was not born persistently infected.

Ear notch (skin) testing is a very easy method to determine PI status. Samples can be taken at birth or anytime thereafter with a pig ear notcher. This is an inexpensive piece of equipment available through any livestock supply catalog. I use the smallest size available; a good sample will be a triangular piece of tissue no bigger than ½” on

each side and about ¼” wide at the widest point. This sample must be refrigerated immediately and shipped to the laboratory within a few days. Taking the sample at birth, if the calf is being processed for weight, navel dipping with iodine, vitamin or selenium injections, and/or tagging and tattooing, is easy and requires little restraint. Obviously, at older ages, more restraint is necessary, although the procedure produces little evidence of discomfort at any age. The notch is taken from the edge of the ear and takes a bite of ear cartilage along with the skin that covers either side. The site heals without stitches or bandaging and is not obvious to even the trained eye once healed.

The National Western Stock Show has implemented a policy of requiring that all cattle admitted to the grounds be tested negative for BVDV PI. This is a boon for everyone involved in showing cattle in this venue. Your own cattle will not be exposed to any PI cattle shedding large amounts of virus (you could still have a few acutely infected asymptomatic animals present however) and any animal you may purchase will not be PI. This policy should be adopted by every show and sale venue in the country.

Persistently infected cattle are defective. They are a constant source of virus for any herd to which they are introduced. They may be prone to multiple diseases due to a faulty immune system and will probably die at a young age. Introduced into a feedlot, they become a source of chronic exposure to an immunosuppressive virus for the remainder of the otherwise healthy calves in a high stress environment. At some point, they may develop Mucosal Disease and die. This at least gets them out of the environment but only after transiently infecting untold other cattle. It also results in high dollar loss, as of course, real money was paid for what was to become a dead calf. Introduced into a breeding herd, PI cattle are a constant source of virus, with a devastating affect on reproductive performance and efficiency. Testing for PI is easy, and can be inexpensive per animals particularly for the newer technologies such as ear notch ELISA or ear notch PCR. Testing for PI animals allows for their removal from the herd, peace of mind for the producer and the knowledge that your integrity as a reputable breeder of registered cattle can be maintained.