Bovine Virus Diarrhea

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Bovine Virus Diarrhea (BVD) is one of the most significant viral infections of cattle. BVD was first recognized as a disease syndrome in 1946. Today, 70 to 90 percent of the world's cattle population is seropositive for BVD.[1] There are at least two genotypes, type 1 and type 2; and two biotypes, cytopathic and noncytopathic. Both type 1 and type 2 genotypes have cytopathic and noncytopathic biotypes as members; and both type 1 and type 2 genotypes have many different strains, some of which are more deadly than others.[2] Recently, the type 2 genotype has caused many of the most severe cases of BVD.[3,1,4]

Clinical Syndromes

Most BVD virus (BVDV) infections are subclinical, but the clinical disease syndromes can be grouped into three categories: acute BVD, in utero infections, and diseases in persistently infected (PI) animals.[1]

Acute BVD can vary greatly in presentation from fever, depression, and runny nose and eyes, to diarrhea to respiratory disease, and can end in complete recovery or death depending on several factors: including, immune status of the animal, strain they are infected with, and age of the animal.[4,1,2] BVDV has a profound immunosuppressive effect on infected cattle.[5] Infected cattle are more susceptible to many respiratory and intestinal pathogens.[6] BVDV also is an important component of Bovine Respiratory Disease Complex (BRDC).[7]

In utero infections with BVDV can result in abortion, persistently infected animals, congenital defects, or normal, immuned calves[8,9] depending on the stage of gestation the cow is in and her immune status when she is infected with the virus. The noncytopathic biotype is responsible for all in utero infections.[1] If a cow is infected with BVD virus in the first trimester of pregnancy, the fetus will most likely die. The cow will reabsorb the fetus, abort, or give birth to a mummified fetus. The abortions usually are sporadic and at a low rate[10]; usually only 2 to 7 percent in an outbreak.[1] If the cow is infected with BVDV between 60 and 120 days of gestation, the calf may be persistently infected (PI).[11] These animals are lifelong carriers of BVDV and shed large quantities of virus in all secretions throughout their lives.[12] The immune system in calves less than 120 days of gestation is not capable of responding properly to BVDV, therefore, the virus multiplies in the calf. When the immune system becomes competent the virus is recognized as "self," and the calf is "immune tolerant" to that strain of BVDV for life; it never develops an immune response to that strain. Infection with BVDV between 100 and 180 days in gestation may result in congenital defects such as cerebellar hypoplasia, hydrocephaly, cataracts, and other similar defects.[13] Infection of the cow in the last trimester of gestation, when the calf's immune system is

functional, will yield a normal, immunized calf.

Persistently infected animals can result from *in utero* infection as described above, or by birth from a PI dam. The prevalence of these cattle are low (0.5 to 3 percent); but their potential to shed large quantities of virus and infect other animals in the herd is tremendous.[14] Persistently infected cows always give birth to PI calves, and seronegative cows (cows that have not mounted an immune response to BVDV) are much more likely to give birth to PI calves. However, some seropositive cows can give birth to PI calves if their circulating antibodies do not cross react with the virus they are exposed to. PI calves often are "poor doers", and are more susceptible to other calfhood diseases due to the immunosuppressive effects of BVDV. Sometimes, however, PI calves may appear normal and healthy.[15] PI calves reportedly have death rates of 50 percent in the first 12 months of life.[1] Some probably die from other calfhood diseases, but many die from BVD-Mucosal Disease (BVD-MD). BVD-MD occurs when persistently infected animals, harboring noncytopathic BVD, are exposed to a cytopathic variant of BVD. This exposure most likely is due to mutation of the noncytopathic strain to a cytopathic strain.[16] BVD-MD is characterized by profuse diarrhea with severe erosions and ulcers on all mucosal surfaces. It most often occurs in cattle 6 to 24 months of age, and is nearly 100 percent fatal.[1]

Transmission

BVDV rapidly loses infectivity outside the host, and is very susceptible to detergents, light, temperature changes and other environmental conditions. It is mainly transmitted by close contact with persistently infected or acutely infected cattle via the oral or nasal routes. Acutely infected animals only shed the virus for a short time (about 2 weeks[1]), whereas PI animals shed constantly in all bodily secretions for life. Acutely infected bulls shed virus in their semen for at least 2 weeks; PI bulls shed virus constantly in their semen, thus, semen is another potential source of infection in natural mating. Reputable artificial insemination services will check their bulls and semen for BVDV.[2] Sheep, goats, and pigs can become infected from close contact with cattle, and sheep can transmit the virus to cattle in close contact. Needles, rectal sleeves, water troughs, feed bunks, nose tongs, and other equipment can aid the spread of virus.[2] It has been shown experimentally that biting insects can also spread the virus.[2]

Diagnosis

Diagnosis of BVD is accomplished by clinical signs, serology, Virus Isolation, Fluorescent Antibody, or Polymerase Chain Reaction (PCR) tests.[1] The virus can be isolated from nasal swabs, serum, or tissue depending on the disease syndrome present. Diagnosis of BVD-Mucosal Disease is very important because if BVD-MD animals are found, the herd should be screened for more PI animals.[2]

Prevention

Adding persistently infected animals to a herd should be avoided as they are the primary method of introducing BVDV into a herd.[2] Replacement animals should be purchased from herds with accurate records of disease prevention and vaccination.[2] All new animals, or at least any small group of new animals, such as bulls, should be isolated and tested for BVDV before entering the herd.[3] Semen should be from tested bulls only. If Embryo Transfer work is performed, all recipients should be isolated, tested for acute or PI BVDV, and vaccinated against BVDV.[3]

Vaccination programs are essential to decreasing losses to BVD. The goal of any vaccination program is to prevent fetal infection and increase colostral immunity. This may not always work, depending on the strain of vaccine and the field strain, but it is the best weapon currently available.[3] Vaccination does not clear persistent infections from a herd[3,5] but the virus does not spread as quickly through a vaccinated herd.[3,6]

The two types of vaccine available are modified live and inactivated (killed), and controversy exists over which is better. Modified live vaccines (MLV) offer more cross-protection against different strains and the immunity conferred by them is longer lasting and stronger.[3] Modified live vaccines should be used with caution, however, as they may cause immunosuppression, fetal infection[4], or revert to virulence.[1] Inactivated vaccines are not immunosuppressive, do not infect feti, and have minimal risk. However, the immune response they generate is weaker, of shorter duration, and may not cross-protect as well as MLV.[4] Cattle receiving inactivated vaccine must also have a booster 3 to 4 weeks after the first vaccination.[4]

Neither MLV nor inactivated vaccines give lifelong protection, and yearly boosters are required with both.[4]

There is no one vaccination program for all situations. Producers should consult their veterinarian for a program tailored to their herd.

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