



BOVINE VIRAL DIARRHEA (BVD)

LIVESTOCK

AGRICULTURE

Introduction

The bovine viral diarrhea virus (BVDV) causes disease in cattle populations worldwide, resulting in significant economic losses. In Canada, BVDV is found in both beef and dairy herds. A study in Saskatchewan and Alberta in 1990 found that 41 per cent of beef cattle sampled had antibodies to BVDV, and almost two-thirds of the farms studied had cattle that had been exposed to BVDV. A more recent study of beef herds in Western Canada found evidence of natural infection in 44 per cent of the herds studied. In dairy herds, different studies across Canada have demonstrated evidence of natural exposure to BVDV ranging from 28 to 53 per cent of herds, depending on region.

Most BVDV infections in healthy cattle do not result in clearly visible disease; however, a wide variety of clinical disease syndromes can occur in cattle, including infertility, abortion and congenital defects in calves. Some animals will develop a more severe condition known as mucosal disease, which can cause high mortality in affected animals.

BVDV may also play a role in the development of bovine respiratory disease. The virus suppresses the immune system, making infected animals susceptible to secondary diseases, especially pneumonia. Research has identified an association between *Mycoplasma bovis* and BVDV infection in feedlot cattle with chronic pneumonia.

Transmission

BVDV is not capable of prolonged survival in the environment, and therefore close contact is necessary to pass the virus from one animal to another. The most effective route of transmission appears to be nose-to-nose contact. Infected animals can shed the virus in all bodily secretions, including nasal discharge, saliva, tears, milk, urine and semen. Some of the highest virus concentrations are found in the manure of infected animals with diarrhea.

This virus has the ability to cross the bovine placenta, allowing transmission from the dam to the fetus. This can lead to a number of different syndromes depending on the age of the fetus at the time of infection. In Western Canada, infection of the non-immune pregnant cow, with subsequent infection of the embryo or fetus, is responsible for most of the economic losses caused by BVDV.

Sheep can be chronic carriers of BVDV and can transmit virus to cattle with which they come in contact. Domestic bison are also known to be affected, as are domestic and wild deer. In white-tailed deer, persistently infected animals will spread the virus within those populations. Spill-back infections, or infection of cattle as a result of exposure to white-tailed deer, while theoretically possible, have not yet been demonstrated.

Consequences of fetal infection

In non-immune pregnant animals, the consequences of BVDV infection will differ depending on the stage of pregnancy at the time of infection.

If the fetus is infected in early gestation (<40 days), the infection may result in early embryonic death and infertility (usually seen as a return to heat), or it may cause the fetus to die and subsequently be aborted.

During the next stage of gestation (40 to 120 days), the immune system of the calf is developing. If the fetus is infected during this time period, the calf's immune system will not recognize the virus. A fetus that survives infection at this stage will be born persistently infected (PI) with the virus. Some of these calves will be stunted, weak, or stillborn, but many may appear to be clinically normal. These PI calves are hidden carriers of BVDV and shed large amounts of the virus, contaminating their environment and maintaining a constant source of infection for other animals. They are also more susceptible to the more serious form of BVDV disease known as mucosal disease.

If the fetus is infected with BVDV between 120 to 180 days of gestation, the calf may be born with congenital defects affecting the part of the brain controlling balance and coordination. These calves will have difficulty walking, and may have tremors, deformed legs, cataracts and blindness.

If the non-immune cow is infected after 180 days of gestation, her fetus will have a functional immune system (i.e. will be immunocompetent). This means that the fetus will be able to produce antibodies to BVDV and will be born immune to the virus. These calves will be normal and will not carry the virus.

Mucosal disease



Persistently infected calf with signs of mucosal disease.

The syndrome known as mucosal disease occurs when a PI calf becomes infected with a different strain of BVDV or when the virus it is carrying undergoes a specific mutation. Mucosal disease usually occurs between six and 18 months of age, but can appear at any age.

Animals with mucosal disease go off their feed, are lethargic, and often have nasal discharge and excessive salivation due to erosions and ulcers in the nose and mouth. The nose and muzzle may have a burnt or peeled appearance because of the extensive erosions and ulcerations. In a post-mortem examination, these ulcers may be found in other parts of the digestive system, such as the esophagus, stomach and intestines. Intestinal lesions result in a foul-smelling, watery diarrhea. Animals often have a fever and become dehydrated as well. Lameness may be present because of ulcers of the coronary band of the hoof. Death often occurs within a few

days.

Occasionally, a chronic form of the disease occurs with chronic weight loss, intermittent bouts of diarrhea, respiratory disease and chronic lameness. These animals often die of pneumonia or other disease because of their weakened immune systems. If PI calves survive until breeding age and become pregnant, their calves will always be born persistently infected as well.



Burnt, peeling muzzle of mucosal disease.

Clinical disease in the non-PI animals

It was previously thought that animals that were not infected with BVDV as fetuses (i.e. not persistently infected) would not experience significant clinical disease if infected with BVDV as a calf or an adult. These animals may occasionally experience episodes of diarrhea and mild fever, but would quickly develop immunity to that strain of virus and recover. They would not become chronic carriers of the virus.

However, new manifestations of BVDV infection in immunocompetent animals have become evident. Some different strains of BVDV seem capable of causing acute, severe disease in normal calves or adults that is virtually identical to mucosal disease. It is very difficult to distinguish these cases from the mucosal disease in PI animals.

Outbreaks of this acute form of BVDV infection, in which large numbers of animals were affected with very high mortality, have been reported in Ontario and Quebec. In many of these outbreaks, abortions were common as well.

It has also become apparent that some strains of BVDV can cause a “bleeding syndrome” in immunocompetent animals. These animals may bleed into their eyes, causing them to appear blind. They will also bleed profusely from injection sites. Outbreaks of this bleeding syndrome have been reported in feedlot cattle in Western Canada.



Ulceration of coronary band of hoof in persistently infected BVD calf.



Cow with nose bleed caused by acute infection with BVD virus in immunocompetent animal.

Treatment

There are no specific treatments available for any of the forms of BVDV infection. Virtually all PI cattle will eventually die from mucosal disease. Immunocompetent animals that are infected after birth either as calves or as adults, can recover depending on the severity of the disease. These animals may require supportive therapy such as intravenous fluids and antibiotics.

Immunity and BVDV

Immunity to BVDV can occur through natural exposure to the virus or via vaccination. Cattle breeding herds can be grouped into four categories based on their immune status and the presence or absence of PI animals:

- a. Naïve herds: herds with no previous exposure to BVDV and with no vaccination history for BVDV (i.e. no natural or vaccine-induced immunity to the virus).
- b. Epidemic herds: naïve herds in which the virus has recently been introduced at the critical time for producing a large number of PI animals. Many manifestations of BVDV infection, such as abortion, congenital defects and mucosal disease cases, will be evident.
- c. Endemic herds: unvaccinated herds that have had a history of natural exposure to BVDV. There is a degree of immunity built up in the herd. There may still be an occasional case of mucosal disease or abortion because of the continued presence of the virus and the lack of total immunity in the herd.
- d. Immune herds: herds that have been vaccinated routinely for BVDV in which all of the breeding females have some degree of immunity.

The most severe epidemic outbreaks tend to occur in naïve herds that have had BVDV recently introduced. The virus may be introduced by purchasing a cow carrying an infected fetus, or by purchasing a PI animal before it has developed mucosal disease. In most outbreaks, it is the PI animal that is responsible for the spread of the virus. Outbreaks may be even more severe in herds that are intensively managed. In these types of herds, various groups of cattle may be raised separately, then mixed together either at breeding or shortly after the breeding season. This can result in naïve animals all being exposed to the virus at the critical period in early gestation, resulting in a large number of PI calves born the following season.

Prevention and control

Removing BVDV reservoirs from the herd, preventing the introduction of the virus and building herd immunity are the three major aspects of BVDV prevention and control. A successful BVDV control program therefore requires the identification and removal of PI animals, basic biosecurity protocols and an effective vaccination strategy.

When BVDV infection is identified in a herd (e.g. through testing sick or dead animals or aborted fetuses), whole-herd testing for PI animals is recommended. Calves can be tested fairly easily to detect PIs. Since the virus can be found in the skin of PI animals, screening calves for PI is best done by testing skin samples (usually an ear notch). This test is advantageous since sample collection is simple, samples can be taken from calves that have maternal antibodies, and a single positive test usually indicates PI status. If any positive calves are detected, then their dams must be tested to determine if they are PI as well.

Once PI animals have been removed, proper biosecurity is essential to prevent reintroduction of the virus. A failure in herd biosecurity often involves purchasing PI cattle or purchasing pregnant cattle with unknown fetal BVDV status. The PI status of any purchased cattle should be determined before their arrival on the farm. All new animals should be isolated for three weeks before entry into the resident herd in order to prevent transmission of BVDV from acutely infected animals. If they are pregnant at the time of purchase, they should be isolated from the main herd until they have calved and the calf's PI status has been determined. If animals leave the farm for show or other reasons, they should be isolated for three weeks before going back into the herd.

Other basic biosecurity measures include avoiding fence-line contact with neighbouring herds and ensuring that people (boots, coveralls) and equipment are sanitary before entering the farm. Also, since BVDV can be passed in the semen, only bulls that have been tested for BVDV infection should be used. Most of these biosecurity protocols for BVDV have the added benefit of minimizing the introduction of other diseases as well.

Vaccination programs should be developed in consultation with a veterinarian in order to provide a program best suited to your specific situation. These programs will be designed to provide breeding animals with an adequate immune response to BVDV.

It is important to protect the breeding female during early pregnancy; therefore, the most appropriate time to vaccinate cattle for BVDV is prior to the breeding season. Particular attention should be given to yearling replacements, as these are the animals least likely to have protective immunity against BVDV. Bulls also need to be vaccinated before being turned out with the cows, since BVDV can be passed in semen.

A number of different vaccines or vaccine combinations are available for BVDV. Most vaccines licensed in Canada contain BVDV in combination with other bovine respiratory and reproductive pathogens. In the past, vaccines contained only one strain of BVDV, but today's vaccines usually contain two or more strains.

Vaccines are available as modified-live vaccines or as killed vaccines. Either type will provide some degree of immunity if they are properly used. The use of a modified-live vaccine prior to breeding is the best way to ensure maximum protection of your cows and the least risk of developing future PI calves. If breeding is already under way before vaccination can be done, killed vaccines can be used as they are safe for pregnant cattle.

When animals are first vaccinated with a killed vaccine they will require two vaccinations. The initial vaccination should be given seven to eight weeks prior to breeding and then "boosted" three to four weeks prior to breeding. A booster vaccine should be given each year thereafter: one dose three to four weeks before breeding. Modified-live vaccines only need to be administered once initially and then each year thereafter at three to four weeks before breeding.

It is important to remember that vaccination will not cure PI animals, and that, even in vaccinated herds, these animals will continue to shed large amounts of virus and will pose an ongoing risk to the rest of the herd.