Different Syndromes Associated with Bovine Coronavirus

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There are three different syndromes currently associated with bovine coronavirus. The three forms are the enteric form, respiratory form, and winter dysentery.

The Enteric Form

The enteric form of bovine coronavirus (BCV) is very common. The antibodies have been found in a large number of adult cattle distributed all over the world.

Dairy and beef calves are both affected by BCV. The age of calves affected is 3 - 21 days. The typical case of enteritis due to BCV occurs at 1 -2 weeks of age. The enteritis usually occurs in the winter because the virus survives in a cool moist environment with a small amount of light.

The virus usually infects the proximal small intestine and spiral colon. When cells become infected, they die, slough and are replaced by immature cells. When the immature cells are present, the absorptive ability of the intestine is decreased, secretions are increased and normal enzyme secretion is reduced. Undigested sugars from digestion in the gut lumen create an osmotic pull. All of these events cause diarrhea. Dehydration, acidosis, and hypoglycemia can occur when diarrhea is severe, causing shock and heart failure.

The clinical signs of the enteric form are a yellow diarrhea which develops approximately 48 hours after infection and continues for 3 - 6 days. Common signs in the acute stages are dullness and anorexia. In more severe cases, pyrexia and dehydration can occur.

Some methods for diagnosing BCV infections are BCV antigen detection ELISA (BCE) assay, direct immunofluorescence, microtiter virus neutralization, direct electron microscopy and PAG-IEM (protein A - gold immunoelectron microscopy). The ELISA assay demonstrates BCV proteins in feces/gut scrapings of calves with neonatal diarrhea or cows with winter dysentery. The direct immunofluorescent technique identifies the viral antigen in the distal small intestine/spiral colon of scouring calves. It is also used to detect the viral antigen of adult cattle with winter dysentery and lungs of animals with pneumonia. The microtiter virus neutralization uses paired sera collected 2 - 3 weeks apart (Carman 1992). The PAG-IEM is a more sensitive test due to detection of viral particles or antigens (Athanassious 1994).

The goal of the treatment is to replace the loss of fluids and electrolytes and to prevent dehydration and acidosis. Fluid therapy should be instituted. Oral fluids should be used because it is more economical and not all absorption is compromised. Also, the sick animals need to be isolated. In most cases the affected calf will recover, but death will occur if the virus is severe enough.

Control of BCV diarrhea depends very heavily on the presence of adequate levels of specific antibodies in the gut lumen. In neonates, the antibodies come from colostrum and milk. Studies have shown that calves with persistent antibodies from the dam were not affected by the enteric form of BCV (Mostl 1990). The animal is most susceptible after passive immunity declines and before an adequate level of active immunity has developed.

One way BCV diarrhea can be controlled is to vaccinate pregnant females which increases the level of antibodies in colostrum and early milk. Research has shown that calves from vaccinated females have a decreased morbidity, fewer scour cases and fewer total sick days (Boland 1995). A possible problem is that calves may not consume enough colostrum shortly after birth (2 hours) and therefore may not be protected.

The other way to control BCV diarrhea is by oral vaccination of neonatal calves to stimulate active immunity and local secretory IgM and IgA production by intestinal mucosa. The vaccine needs to be administered before colostrum because the colostrum may inactivate the virus within the vaccine.

The Respiratory Form

BCV is an enteric pathogen and can cause a respiratory tract infection in a varying group of calves. The infection is usually subclinical, but when this occurs, calves between 2 and 16 weeks of age may show clinical signs before enteritis develops.

The primary sites of infection in the respiratory tract are epithelial cells of the nasal cavity and trachea. When these areas are infected, mild upper respiratory signs occur such as: rhinitis, sneezing, coughing, and increased respiratory rates. When BCV attacks the res-

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piratory system, usually the infection is not severe enough to warrant treatment, but may predispose calves to more severe secondary lower respiratory tract infections. A differential diagnosis list would include enzootic calf pneumonia, bronchopneumonia, and contagious bovine pleuropneumonia.

There is now evidence that BCV originating from the enteric and respiratory tracts are antigenically and serologically identical. Infected calves usually have BCV in both enteric and respiratory tracts simultaneously (Clark 1993). The respiratory form can be detected by direct immunofluorescent staining of nasal epithelial cells and antigen detection by ELISA.

Winter Dysentery

Winter dysentery is an acute intestinal disorder of adult cattle. It usually affects dairy cattle in the northern U.S. The disease most commonly occurs from November to March and is highly contagious. One reason is that cattle go through parturition during this time of year and this is an extra stress and predisposes early postpartum cattle to winter dysentery. The most susceptible group is periparturient cattle between 2 - 4 years of age. An unusual feature of this disease is that calves less than 9 months old are unaffected possibly due to antibodies from colostrum.

Clinical signs are severe diarrhea that can be blood tinged or black and has a characteristic musty, fetid odor, severe decrease in milk production, variable depression, anorexia and possibly a mild cough with a nasolacrimal discharge. The disease has a high morbidity of 50 - 100% with a low mortality of 1 - 2%. The disease is spread through feces. Cattle that have had the disease cannot be reinfected for several years. There is no specific treatment for winter dysentery, but the disease is self limiting and the prognosis is good.

Studies have shown that cows showing classic clinical signs of winter dysentery were infected with coronavirus infection according to serologic evidence. The histologic lesions that are present in the crypts of the spiral colon are similar to those in calves with BCV enteritis. After a lot of different studies were performed, a similar conclusion was noticed namely, winter dysentery is caused by a coronavirus. It depends on which study is read. Some say that it is the etiologic agent of winter dysentery; others claim that it is an opportunistic invader that is part of the normal microflora of the adult bovine gut. All the findings agree that the epidemiology of winter dysentery is consistent with BCV being a causative agent. BCV survives best in low temperatures and low UV light thus leading to higher levels in the environment and this is when most winter dysentery occurs. Also there are more coronavirus organisms shed during the winter due to extra stress and parturition. Since BCV may be transmitted by both oral and respiratory routes, the spread of infection is increased by close confinement of large numbers of cattle during the winter months.

In conclusion, BCV can occur in three different syndromes: the enteric form, respiratory form and it is a proposed etiologic agent of winter dysentery. The enteric form is the most common and the most severe syndrome of BCV because it can kill young calves. The respiratory form does occur; it is not as clinically important depending on the strain. Respiratory signs usually occur before the enteritis from BCV. BCV is now being considered as the etiologic agent for winter dysentery because BCV thrives in the environment where winter dysentery occurs.

References

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Student Clinical Reports

The AABP Board of Directors has approved a recommendation from the Forward Planning Committee to encourage students to write case reports for this journal and to award prizes. Susan K. Bradish, Pullman, WA, was awarded the $200 first prize; Karen Spiece, Greenville, PA was awarded the $100 second prize (January, 1997 issue, p 106-108); Todd R. Conner, Edmeston, NY received the $75 third prize.