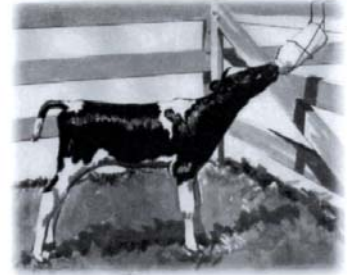


FrontLine®

TECHNICAL INFORMATION FOR TODAY'S FEED PROFESSIONAL



Intestinal Disorders Caused By Viruses Part 1

VIRUSES

Viruses are tiny particles which are usually visible only under an electron microscope. Their size is given in nanometers (1nm = 1 nanometer = 1 millionth part of a millimeter). In contrast to plants or animals which always have two types of nucleic acids as carriers of genetic information in the cell nucleus, viruses only contain one of these nucleic acids, either DNA or RNA.

Viruses possess no enzymes for energy metabolism and cannot therefore grow and multiply by themselves. For this reason they are resistant to antibiotics.

In order to multiply, they reverse the energy metabolism of an animal or plant cell, forcing the host cell to produce virus-specific nucleic acids and proteins for the new viruses being formed. Viruses are therefore cell parasites. A special feature is the fact that shortly after infecting a host cell the viruses can, temporarily, no longer be demonstrated, not even in a test for infection. It is assumed that the complete virus is divided into smaller sub-units, controls the genetic apparatus of the host cell in this form and does not reappear, multiplied, in the same shape until a later phase. The host cell dies during this process.

ROTA AND CORONA VIRUS INFECTION

A few years ago it was shown in the U.S.A. that diarrhea in pre-weaned calves is caused by viruses and that this condition is not, as previously been assumed, exclusively due to bacterial infection (particularly with coli pathogens). This severe contagious form of diarrhea is precipitated by rota and corona viruses.

Incidence

The condition occurs frequently among calves in dairy herds where the causative organisms are nearly always present. An increased incidence of the disease is observed in cattle barns where several calves are born within a short period. With each additional calf the clinical profile deteriorates and death results in an increasing number of cases. This type of diarrhea is also seen on farms purchasing their calves at less than 3 weeks of age.

Pathogen/Cause

The actual cause of diarrhea are viruses belonging to the rota and corona group. Rota and corona viruses also occur in pigs, horses and sheep.

Rota and corona viruses are typical examples of pathogens that are constantly present in the stock, but do not cause disease in older animals.

The shorter the interval between individual outbreaks of the disease, the worse the clinical profile. This is probably due, on the one hand, to an increase in the pathogenic properties (enhanced virulence) of the organism when passing from animal to animal, and on the other hand to the constantly rising number of pathogens and thus to a concentration in the environment (increased exposure to infection). For this reason the disease is rare in those stocks where only few calves are born throughout the year. However, the disease is a problem on farms where many calves are born within a short time (e.g. with synchronization of heat periods). With few, well-spaced calvings in the year, the chain of infection is interrupted in a natural way. On farms where there are many calvings at short intervals, the interruption of the chain of infection is the most important preventive measure against rota and corona virus infection.

Transmission/Route of Infection

Since the pathogens are present in virtually all herds, any calf may contract the disease.

The following factors increase the exposure to infection and the susceptibility of the calves:

- Insufficient and incorrect care after birth:
 - Incorrect removal of mucus from the mouth with dirty fingers

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- Late and inadequate feeding with colostrum
- Incorrect housing of the newborn calves:
 - Tying the calves to cold, moist external walls
 - Tying up the calves behind the cows near the gutter (contact with pathogen-containing feces of the cows)
- Inappropriate calf housing:
 - Unfavorably controlled environment
 - Calves placed too close together (infection through contact with neighboring calves)
- Errors in the use of the various milk replacers:
 - Incorrect milk temperature
 - Incorrect solids concentration of the milk replacer.

Course and Symptoms

A rota virus infection often occurs as early as the first week of life, a corona virus infection usually in the 2nd or 3rd week of life. In many cases both types of viruses are involved in the disease process.

Having been ingested through the mouth, the viruses quickly pass into the small intestine.

They invade the epithelial cells of the tips of the villi where they rapidly multiply and initially destroy the tips of the villi.

The calves display loss of appetite, dullness and fever at this stage. Because the epithelial cells cannot regrow from the base of the villi as quickly as they are destroyed by the viruses at the tip, the villi are mutilated. Due to the multiplication of the viruses more and more villi are attacked and damaged, with the result that they no longer produce sufficient intestinal juices and enzymes. The chyme is broken down inadequately. The remaining intact parts of the intestinal villi only take up a reduced amount of nutrients, salts and water.

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The cells regrowing from the base of the villi do produce a great deal of mucus, but hardly any enzymes. The undigested chyme is broken down by bacteria in processes of decomposition and fermentation, finally bringing about a shift of the pH value in the small intestine. The animal's body tries to balance this pH change by releasing more fluid from the tissues into the intestine.

The decomposition of the undigested protein from the milk causes the pH value in the intestine to rise. As a result of this pH shift into a less acid range, bacteria, especially coli bacteria, may ascend from the large intestine to the small intestine, giving rise to a secondary bacterial infection.

Insufficient elimination of water from the intestine and increased inflow of water from the body tissue cause the intestinal contents to be greatly diluted. Peristalsis is enhanced and diarrhea appears. The feces are aqueous, foaming and are forcefully ejected. As a result of the intestinal irritation, the calves are constantly straining to pass feces. The pain may be seen from the drawn-in abdomen.

Diagnosis

The course of the diarrhea in the herd, particularly its very early appearance in pre-weaned calves during the first few days of life, is typical of this infection.

The failure of antibiotic treatment also points to the presence of a viral infection.

The isolation of the virus is extremely difficult. In the living animal it is successful only if a fecal sample is collected within the first 2 to 4 hours following the appearance of the symptoms of diarrhea. The sample must be deep-frozen immediately and must not be allowed to thaw until the time of examination. This examination can only be carried out in specialized laboratories.

In the animal that has died, the gas inflated, paper-thin intestine is typical.

An examination under the microscope shows the atrophy of the intestinal villi. Today the virus can also be demonstrated immediately after the animal's death. If a rota/corona infection is suspected, but the fecal examination does not reveal any viruses, this does not prove that the condition is not due to a virus infection. In that case the test for rota and corona viruses should be repeated as soon as the next calf shows symptoms of diarrhea or immediately after an animal has died. In many cases the viruses are not demonstrated until a second or third fecal examination is carried out.

Treatment

When the rota and corona virus infection appears, specific treatment is not possible, but has to be confined to supportive, alleviating and life-preserving measures.

With diarrhea, the main steps to be taken are:

- Life-preserving measures:
 - Replacement of milk by electrolyte solution
 - Supporting the circulation
 - In severe cases subcutaneous or intravenous injection of a glucose electrolyte solution in addition to giving the solution in the milk
 - Preventing or containing a secondary bacterial infection by the administration of antibiotics
 - Temporary provision of heat (heating lamp)
- Restoring the natural intestinal function:
 - Gradual change-over to milk replacer
 - Administration of antibiotics during the change-over to milk feeding
 - Use of lactic acid-forming bacterial culture

The interruption of the chain of infection is the most important preventative measure against rota and corona virus infection.

In problem stocks the following program has proven to be successful:

- Hygienic measures
 - Immediate removal of the newborn calves from the calving area into a carefully cleaned and disinfected calf barn that is separated from the remaining herd, or at least placing the animal in a calf pen. Special care should be taken to ensure that the calf has as little contact as possible in the calving area with the feces of the calves and cows kept here.
 - When milking the Colostral milk, cleanliness is particularly important. Within the first 6 hours of life the calf should take up to 2 to 2.5 liters (1/2 gallon) of colostrum for maximal effect of the immunoglobulins.
 - Contact of the calves with the dairy barn and the feeders/milkers of the dairy cows should be avoided. The best solution would be for one particularly careful person to look after the calves. The clothing used for this purpose, especially the shoes, should only be worn in the calf barn.
- Medical care after birth
 - Administration of living, lactic acid-forming bacterial cultures appropriately prepared, and 1 million I.U. of vitamin A by mouth, the BOVIFERM method. Given together with the colostrum, lactic acid-forming bacteria enable *Enterococcus faecium* (also called *Streptococcus faecium*) to spread rapidly throughout the small intestine.

The lactic acid production of these bacteria promotes the build-up of the vital lactoflora and creates unfavorable living conditions for harmful pathogens.

Before they receive the first colostrum, the calves in a problem herd are additionally given bovine immunoglobulins by mouth and by injection, in order to enhance the passive and active resistance of the newborn calf to bacteria and viruses. At the same time high doses of vitamins A, D₃, E and C in aqueous form are administered in order to stabilize the skin and mucosae and to stimulate the metabolism and growth. Bovine immunoglobulins and vitamin A are given at this early stage, because the absorbability is highest during the first few hours of life.

In a problem herd, where almost all the calves contract confirmed rota and corona infection and where many of the animals die, vaccination should be carried out.

Vaccination of the dam, which can prevent rota and corona virus infections, has recently been introduced whereby two doses of the vaccine are given 6 to 8 weeks and 3 to 4 weeks before calving. This vaccination aims to raise the level of antibodies against rota and corona viruses and against coli bacteria in the Colostral milk. However, this does not mean that the program mentioned above can be dispensed with, since the raised antibody levels in the colostrum can only become effective in conjunction with these measures. In particular, early and adequate administration of the colostrum should be ensured. This vaccination of the dam should be carried out throughout the herd. Every cow should be vaccinated before calving.

Vaccination of the calf can be carried out immediately after birth, using a modified live vaccine against rota and corona viruses. The vaccine is given by mouth directly after birth. Initially, during the first few hours of life, it provides non-specific protection and subsequently stimulates the formation of specific antibodies whereby the calf can build up its own active immunity. Here it is important that the calves are not given any Colostral milk until two hours after vaccination. Otherwise the antibodies in the Colostral milk would neutralize the modified virus of the vaccine and thus prevent immunization.

In newborn calves an injection of dam's blood is a very effective and reliable, though rarely used, method of prevention, and not only of rota and corona virus infection. Its effect is due to an increase in non-specific resistance to infection. Stimulation of the metabolic processes in young calves along the lines of an irritation therapy may also be observed. With this method, 100 cc of blood is collected from the dam within the first 12 hours after calving and injected into the calf subcutaneously at several different sites. For this purpose a 100 cc bottle of stored blood containing a special sodium citrate solution to prevent coagulation was used. With the blood-taking set provided with it, the dam's blood can be collected sterile for injection.