



THE VETERINARY LINK

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Calf diarrhea caused by *E. coli*

E. coli is one of the most common types of bacteria in nature and makes up the majority of the normal bacterial population in the digestive tract of both humans and animals. *E. coli*, short for *Escherichia coli*, refers to a group of bacteria with many families and subfamilies.

Most types of *E. coli* are harmless to cattle and humans, but a few are harmful to specific species. For example, *E. coli* H7:O157 has become infamous for causing disease in humans, yet it causes no problems in cattle, deer and other animals. *E. coli* K99 causes diarrhea in young calves but not in humans or other animals.

The most common disease caused by *E. coli* in young calves is caused by *E. coli* K99 and is sometimes called enterotoxigenic *E. coli* or colibacillosis. The word enterotoxigenic means the bacteria produce a toxin that is released into the intestine.

The disease usually affects calves less than 3 days of age (as early as 12-18 hours after birth) and occasionally occurs in calves up to several days of age, but never in adults. Only the cells lining the intestines of very young calves have an attachment site for the bacteria. As the calves age, the cells of the intestinal tract mature and lose the site where the bacteria can attach.

Occasionally, calves older than 2-3 days will scour due to *E. coli* K99. In these cases, the calves have a viral infection of the intestinal tract (most likely rotavirus or coronavirus), which damages the lining of the intestinal tract. The new cells that repair the damage have attachment sites like the intestinal lining cells of young calves.

Unique to K99

While most other types of *E. coli* do not cause disease in calves, K99 does. Two factors make this type of *E. coli* unique. The first is the presence of small "arms," called pili or fimbriae, which allow them to adhere to specific attachment sites on the cells lining the intestinal tract of very young calves (the name of this pili is K99).

The second factor that allows this type of *E. coli* to cause scours is the production of a toxin that causes the intestinal cells to secrete fluid and electrolytes into the digestive tract. This pulls fluid and electrolytes from the tissues and blood into the digestive tract where they are lost in the diarrhea.

The primary factors involved with an outbreak of colibacillosis are:

1. The immune status of the calves (the amount of colostrum protection received); and
2. The amount of exposure to *E. coli* K99 organisms – affected by population density and number of sick or recovered calves in the same environment.

Factors such as nutrition of the dam, weather and calf birth weight are involved because of their effects on dystocia, calf vigor and colostrum absorption.

Calves with K99 colibacillosis have watery to pasty diarrhea that is usually pale yellow to white in color, and it is occasionally streaked with blood flecks. Mildly to moderately affected calves may scour for a few days and recover spontaneously with or without treatment.

Throughout the course of the diarrhea, the degree of dehydration will vary from just barely detectable (4%-6% of body weight) up to 10%-16%, which is life-threatening. The disease responds reasonably well to treatment in the early stages. If death occurs, it is due to acidosis, electrolyte imbalance and dehydration.

Treatment

Treatment of colibacillosis includes the use of oral or intravenous (IV) fluids and good nursing care (warm, dry and comfortable). The major factor influencing survival is the level of colostrum immunity in the calf at the onset of diarrhea. The prognosis is unfavorable if the level of immunoglobulins from colostrum is low, regardless of intensive fluid therapy.

Oral electrolyte mixtures are available to be mixed with water and fed with a bottle or tube-feeder. In cases of severe dehydration and acidosis, solutions containing bicarbonate are indicated.

Many veterinarians recommend alternating milk feedings with electrolyte or water feedings (but not at the same time) because it has been suggested that withholding milk from diarrheic calves can result in malnutrition, decreased growth rates and prolonged recovery. If the calf is severely dehydrated, depressed and unable to sit up, giving fluids intravenously is indicated.

Remove risk factors

Removal of risk factors (dystocia, crowding, poor dam nutrition, exposure to scouring calves, etc.) is often the most successful treatment for calf scours and is an excellent preventive measure.

Strategies to improve protection by passive transfer of antibodies from a dam to her calf via colostrum by stimulating the dam's immune system also have been attempted. Vaccines to protect against enterotoxigenic *E. coli* are directed against K99 pilus antigens. Pilus antigens are good vaccinal antigens because they are made of protein and are located on the bacterial surface where they are readily accessible to antibodies. In addition, K99 pilus antigens are required for a critical step (adhesion-colonization) early in the disease process.

Despite the logic for increasing colostrum titers to K99 pilus antigen, thereby increasing passively acquired protection of suckling calves, data on how well commercial vaccines work in on-farm studies are inconclusive.

Results of some studies failed to document a benefit in rate of calves that scour or die from scours after vaccination of dams during late gestation, even though titers to K99 antigen were substantially higher in the colostrum of vaccinated dams. Other researchers have reported decreases in the rates of both illness and death of calves when their dams were vaccinated with K99 antigen during late gestation.

Another type of *E. coli* that can cause death in calves is "attaching and effacing *E. coli*." This type of *E. coli* causes damage to the large intestine and causes a bloody diarrhea in calves 2-5 weeks of age. This type of *E. coli* produces a different type of toxin that damages the lining of the large intestine. Vaccinations that control *E. coli* K99 have no effect on attaching and effacing *E. coli*.

