

Veterinary Technician Program

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Pathogenesis of Diarrhea in Calves

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Abstract

Calf diarrhea (scours) remains an important cause of illness and death in both dairy and beef herds. There are several viral, bacterial and protozoal pathogens that cause diarrhea in calves; many clinical cases of diarrhea result from infection by more than one pathogen. Infection with diarrhea-causing pathogens causes tissue damage and malfunction, which may lead to dehydration, electrolyte imbalances, acidosis, hypoglycemia, hypothermia, and other problems.

Résumé

La diarrhée des veaux demeure une cause importante de maladies et de mort chez les bovins laitiers et de boucherie. Plusieurs microorganismes pathogènes (virus, bactéries, protozoaires) causent la diarrhée des veaux ; de nombreux cas cliniques de diarrhée sont dus à l'infection par plus d'un agent pathogène. L'infection par les agents causals de la diarrhée endommage les tissus et dérègle leur fonctionnement, ce qui peut entraîner la déshydratation, le déséquilibre des électrolytes, l'acidose, l'hypoglycémie, l'hypothermie et d'autres problèmes.

Introduction

Calf diarrhea, commonly called scours, remains a problem in the beef and dairy industries. In the 1997 National Animal Health Monitoring System (NAHMS) survey by the US Department of Agriculture, more than 20% of beef producers agreed that calf scours "had a significant economic impact on the cow-calf operation in the past 12 months, including the cost of prevention, cost of treatment and lost production".¹ In the 2003 NAHMS dairy survey, dairy producers attributed 62.1% of death losses in unweaned heifers to gastrointestinal disease, including scours.²

How is the cause of scours determined?

Most moderate to severe cases of scours in calves are infectious in nature (some mild cases of diarrhea may result from the calf's diet). Many infectious cases of diarrhea involve more than one pathogen.³ Diagnosis of the responsible pathogen or pathogens in a particular case can be challenging, as fecal culture may not identify all pathogens present, and some organisms that can cause diarrhea may also be present in healthy calves. In addition, dead calves submitted to the veterinary diagnostic laboratory may have intestinal bacterial overgrowth or postmortem tissue destruction (autolysis) that may make identification of diagnostic intestinal lesions difficult or impossible. The best diagnostic sample during an outbreak of scours is an acutely affected but still living calf; however, useful information may be obtained from fecal culture of a sick calf or necropsy of a freshly dead calf.

Diagnosis of the pathogen causing scours cannot be made by clinical signs alone. Still, information about the typical clinical expression of common scours pathogens can enable an educated guess about which pathogen or pathogens are likely to be involved. This will allow the most appropriate therapy to be instituted while diagnosis is pending.

Which pathogens cause scours?

In the first four days of life, the most common cause of scours in calves is infection with *Escherichia coli* bacteria. Rotavirus also occurs most commonly in the first week of life, though it may occur at any time during the first month or so. It is not uncommon for calves with rotavirus to have blood and mucus in their feces.

Coronavirus occurs most commonly in calves over a week of age, although like rotavirus it may occur anytime during the first month of the calf's life. *Cryptosporidium parvum* is also a common pathogen in

calves over a week of age, and infection with cryptosporidia commonly results in production of feces containing blood and mucus. Coccidial infection may also cause diarrhea tinged with fresh blood in calves over one week of age.

Salmonella species and *Clostridium perfringens* are bacteria that uncommonly cause diarrhea in calves. *Salmonella* behaves much like *E. coli*, causing serious illness in very young calves. Clostridial infection also causes very severe illness, with a clinical course that commonly leads to death within 12 to 24 hours after the onset of clinical signs.

How do diarrhea pathogens cause disease?

Most cases of diarrhea in calves involve some combination of malabsorption of nutrients in the gut, hypersecretion of fluids, and intestinal inflammation (enteritis and/or colitis). Protozoa such as cryptosporidia and viruses such as rotavirus and coronavirus destroy the intestinal villi that absorb fluids and nutrients from the gut. Destruction of intestinal villi results in decreased nutrition and hydration of the calf and increased fluid and unabsorbed nutrients in the gut. The increased level of nutrients in the gut during a viral infection can produce a 5,000 to 10,000-fold increase in the number of bacteria present in the intestines.⁴ Pathogenic bacteria promote hypersecretion of fluid and electrolytes through the gut wall and into the gut lumen, which contributes to fecal fluidity, dehydration, electrolyte imbalances, and acidosis. The bacteria that proliferate in the gut during bacterial or viral enteric infections produce D-lactic acid, a significant contributor to systemic acidosis in affected calves.⁵

Dehydration, acidosis and electrolyte imbalances may lead to other physiological problems. Severe dehydration decreases tissue perfusion by blood, which promotes the production of L-lactic acid, a contributor to acidosis. Acidosis increases the likelihood of impaired cardiac function, the risk of blood infection (septicemia),

and decreases blood potassium, contributing to hypokalemia, which may promote cardiac arrhythmias. About 30% of calves less than one week of age with diarrhea and systemic signs may be expected to have bacteria in their bloodstream.⁶

Calves with severe scours may also become hypoglycemic, particularly if they are in poor body condition and/or have been held off milk during their illness. Hypoglycemia increases the likelihood that the animal will also suffer from hypothermia.

Summary

A variety of pathogens may cause diarrhea in calves and they may be bacterial, viral, or protozoal. The cause of diarrhea cannot be determined by clinical signs, but the age of the calf and the clinical signs may be used to form a hypothesis about which pathogens are most likely, until a definitive diagnosis can be made. Many cases of scours in calves may be due to more than one pathogen. Most cases of scours involve some combination of inflammation, malabsorption, and hypersecretion in the gut, which may lead to dehydration, acidosis, electrolyte imbalances, hypoglycemia, septicemia and hypothermia in affected calves.

References

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