



# Clostridial Diseases of Cattle

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Vaccinating for clostridial diseases is an important part of a ranch health program. These infections can have significant economic impacts on the ranch due to animal losses. There are several diseases caused by different organisms from the genus *Clostridia*, and most of these are preventable with a sound vaccination program. Many of these infections can progress very rapidly; animals that were healthy yesterday are simply found dead with no observed signs of sickness. In most cases treatment is difficult or impossible, therefore we rely on vaccination to prevent infection. The most common organisms included in a 7-way or 8-way clostridial vaccine are discussed below. By understanding how these diseases occur, how quickly they can progress, and which animals are at risk you will have a chance to improve your herd health and prevent the potential economic losses that come with a clostridial disease outbreak.

## The Genus *Clostridium*

**Anaerobic** bacteria do not require the presence of oxygen to grow. Anaerobic bacteria may be obligate (harmful by the presence of oxygen), tolerant (will still grow in the presence of oxygen), or facultative (don't require oxygen but will use it if present). Clostridial organisms are all obligate anaerobes, they require the complete absence of oxygen to grow.

*Clostridia* are a genus of gram positive rod shaped bacteria that are normally found in the soil and the digestive tract of healthy animals. Their prevalence means that even the best biosecurity program can't prevent animals from being exposed. These bacteria often exist without causing problems until the right circumstances allow them to cause disease. They are strictly **anaerobic**, which means they require the

**Sporulating** bacteria, such as *Clostridia* and *Bacillus*, form endospores that protect bacterial DNA from extreme conditions such as heat, cold, dry, UV radiation, and some disinfectants. Unlike fungal spores, these spores cannot proliferate; they are dormant forms of the bacteria that allow survival until environmental conditions are ideal for growth.

absence of oxygen to survive. *Clostridia* are one genus of bacteria that have the unique ability to **sporulate**, forming microscopic endospores when conditions for growth and survival are less than ideal. Once clostridial spores reach a suitable, oxygen free, environment for growth they activate and return to their bacterial (vegetative) state. They can then begin to multiply and produce potent toxins that cause disease in most mammals (including humans). The prevalence of clostridial organisms and ability to survive even in dry, hot soil makes them a regular threat to livestock.

## Blackleg (*Clostridium chauvoei*)

Blackleg is a typically fatal disease of cattle caused by the bacteria *Clostridium chauvoei*. Young animals (4 months to 2 years) that are well-fed, healthy, and growing are the most commonly affected and the rapid onset of the disease means treatment is usually unsuccessful. *C. chauvoei* are normally found in the intestines of cattle and sheep, but also persist in soils where they may be picked up by grazing animals. The spores cross from the digestive tract to the bloodstream where they are deposited in tissue throughout the body. Once they find a suitable oxygen depleted site they become active and begin causing disease which progresses rapidly. Muscle overexertion or damage that causes bruising may trigger active disease. Infected animals may exhibit signs of lameness, fever, and decreased appetite along with a characteristic gaseous swelling under the skin of large muscle groups such

as the upper leg, hip, shoulder, or neck. Death usually occurs in 12 - 48 hours. Because the disease progresses so rapidly, often the only indication of an outbreak is a dead animal with significant swelling of affected muscle tissue and gas accumulation under the skin. Affected muscles will also have areas of black, necrotic tissue with a foul odor.

## **Malignant Edema (*Clostridium septicum*)**

Cattle with open wounds such as cuts, abrasions, or castration sites may be vulnerable to infection by *Clostridium septicum*, the bacteria responsible for malignant edema. *C. septicum* inhabits the intestinal tract of most livestock, it is shed in feces and typically infects healthy tissue through the contamination of open wounds such as cuts or castration sites. Cows may become infected after a difficult calving that causes injury to the reproductive tract. Malignant edema infection causes local fluid accumulation (edema) and swelling near the wound, along with high fever and decreased appetite. The affected tissue in deceased animals will be darkly discolored with a necrotic odor but will not typically have the gas accumulation associated with blackleg. Treatment with penicillin is effective only if started very early in disease onset; animals that survive are often disfigured. Death typically occurs in 24-48 hours and the only signs of infection may be one or more dead animals.

## **Black disease (*Clostridium novyi*)**

Feedlots are the operations most frequently affected by Black disease. It is caused by *Clostridium novyi* type B and likely gets its name from the characteristic darkening of the underside of the skin. The exact routes of infection are not clear but as with other clostridial organisms, it is likely that *C. novyi* is transmitted orally or through a contaminated wound. The spores cross the intestinal lining and take up residence in the liver. Cattle infected with liver flukes are more prone to *C. novyi* infection; the damage caused by the flukes creates the ideal oxygen reduced environment for the bacterial spores to germinate. The bacteria then release a toxin ( $\alpha$ -toxin) which causes widespread edema and necrosis of the liver. As with many of the clostridial diseases, the sudden death of apparently healthy animals may be the only sign of disease.

## **Redwater (*Clostridium haemolyticum*)**

Cattle that live in or near marshy, wet, lowland areas, where liver flukes are common, may also be susceptible to *C. novyi* type D, also called *Clostridium haemolyticum*. *C. haemolyticum* causes a disease known as redwater. Adult cattle tend to be more easily infected than younger animals. The organism survives in the soil and in the carcasses of infected animals. Similar to black disease, *C. haemolyticum* spores or vegetative bacteria enter the digestive tract, cross the intestinal lining, and settle in the liver. Liver damage (such as from liver flukes) may create the ideal conditions for germination. *C. haemolyticum*

releases a toxin ( $\beta$ -toxin) which causes liver necrosis. The toxin also enters the bloodstream where it destroys red blood cells. The excess hemoglobin from these destroyed cells is released in the urine, causing it to have a red tinge (hence, redwater). Signs of infection include fever, pale mucous membranes, decreased appetite, abdominal pain, and red-tinged urine. Clinical signs can last as few as 12 hours in pregnant cows up to 3 or 4 days in other cattle. High doses of antibiotics may successfully treat the disease if administered early.

## **Enterotoxemia (*Clostridium perfringens*)**

Enterotoxemia in cattle and calves is typically associated with *Clostridium perfringens* (types A through D), although several other clostridial organisms may also cause it under the right conditions (e.g. *C. septicum*, *C. sordellii*). *C. perfringens* type C is a common cause of death in calves. In newborn calves, it causes necrotic enteritis. Calves develop abdominal pain, weakness, and depression along with bloody diarrhea. Symptoms appear suddenly and calves often die before showing signs of infection. Type C is a normal inhabitant of the digestive tract; infection is usually brought on by a sudden increase in milk intake (such as when calves are returned to the cows after a separation for management practices). *C. perfringens* Type D is often called "overeating disease", and is common in older calves (<2 years) that are being fed a high grain ration. Again, this organism is commonly found in the digestive tract of animals and ingestion of excess feed can trigger the disease. Calves exhibit decreased appetite, weakness, diarrhea, and incoordination.

## **Sudden Death Syndrome (*Clostridium sordellii*)**

*C. sordellii* is commonly associated with "sudden death syndrome" in feedlot cattle. Typically, there are no signs of disease or infection other than the sudden death of one or more animals. Upon necropsy, these animals exhibit necrosis and massive hemorrhage in the brisket and throat area with little or no gas accumulation. Transmission is not known, but oral transmission is suspected.

## **Lockjaw (*Clostridium tetani*)**

Tetanus (more commonly known as lockjaw) is caused by the neurotoxin releasing bacteria *Clostridium tetani*. Like most clostridial organisms, *C. tetani* is found in the soil and the digestive tract of animals. It's most commonly associated with puncture wounds, but any minor wound such as docking site, castration site, ear notch, ear tag, or injection site can be a source of entry for the bacteria. Unlike the fast acting agents of blackleg or malignant edema, *C. tetani* is relatively slow moving with an incubation period of 24 hours to 2 weeks. The toxins produced can either disseminate through the vascular system (descending tetanus) or travel up the axons of nerves (ascending tetanus) to reach the spinal cord. As they cross nerve synapses, they bind the terminals causing sustained spasms and rigid muscle paralysis. Signs of infection

include muscle tremors, difficulty chewing and swallowing, and muscle rigidity spreading to the back and tail. Death occurs from respiratory failure in a few days to 2 weeks' time. Treatment with antitoxin and/or antibiotics may be effective if administered early, especially if administered prophylactically (after a potential wound but before any signs appear).

## The Bottom Line

The fast acting nature and prevalence of these diseases makes timely diagnosis and treatment extremely unlikely. An outbreak can have serious financial implications to the bottom line of a ranching operation. Vaccination is extremely effective and vaccinations for the bacterins and/or the toxins they produce are available in a variety of combinations, the most common being the 7-way or 8-way clostridial. Typically, the 8-way will contain the bacterin for *C. haemolyticum* (redwater) while the 7-way does not. In addition to vaccinating for the Clostridial diseases, a well-designed ranch vaccination program should include vaccinations for other viral and bacterial disease complexes (i.e. Infectious Bovine Rhinotracheitis, Parainfluenza Type 3, Bovine Viral Diarrhea, Brucellosis, Pasteurella, Hemophilus, Bovine Respiratory Syncytial Virus, Vibriosis, and Leptospirosis). Consult with your veterinarian to develop a herd vaccination protocol that best protects your cattle and calves. Always follow all label instructions, including proper vaccination handling, administration, and withdrawal times as well as Beef Quality Assurance practices.

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Bacterium	Disease	Most Commonly Affected Animals
<i>Clostridium chauvoei</i>	Blackleg	Well fed, growing animals 6 months to 2 years
<i>Clostridium haemolyticum</i>	Redwater	Adult cattle in marshy, lowland areas especially with liver damage (such as from liver flukes)
<i>Clostridium novyi</i>	Black disease	Growing animals in feedlots
<i>Clostridium perfringens</i> (types C & D)	Enterotoxemia	Calves of all ages, especially during periods of diet changes or increases, or cattle on a high-grain ration
<i>Clostridium septicum</i>	Malignant Edema	All cattle, especially associated with an injury
<i>Clostridium sordellii</i>	Sudden Death Syndrome	Feedlot cattle
<i>Clostridium tetani</i>	Lockjaw	All cattle, especially associated with an injury



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