

Clostridial Diseases

Clostridial Organism

- Gram-positive, anaerobic, rod-shaped bacillus most commonly found in the soil and intestinal tract of cattle, sheep, and other ruminants and humans.
- Can exist in a vegetative state or as a spore

Clostridial Bacteria

Clostridia bacteria have three important qualities:

1. Multiply only in the absence of oxygen
 - (Anaerobic)
 2. Have the ability to survive adverse conditions by transforming into highly resistant forms called spores; (survive for years in the soil)
 3. Release potent toxins during the process of multiplying
- In their spore form, clostridia are able to exist in the soil, on body surfaces and within the healthy animal.
 - Clostridia do not cause disease unless tissue is damaged which then provides a favorable environment where the dormant Clostridial spores are able to transform into active multiplying bacteria.
 - During multiplication, toxins are released which can destroy muscle tissue, destroy red blood cells, or interrupt nerve impulses,
 - Consider sites of disease into 3 groups
 - Tissue: Histotoxic muscle liver group
 - Gastrointestinal: Enterotoxic (gut) group.
 - Nervous System: Neurotoxic

Pathogenesis of Clostridial Diseases

- Can be divided into 2 categories
 1. The organism actively invades and reproduces in the tissue of the host (muscle, liver) with the production of toxins, which enhance the spread of infection and death of the host
 - examples include malignant edema (gas gangrene group), black leg,
 2. Those characterized by toxin production in the GI tract, devitalized tissue, food or carrion
 - Enterotoxemia, tetanus, botulism

Histotoxic group of Clostridia

- Usually enters the body through wounds or ingestion, spores lie dormant until a suitable environment for their activation occurs
- Any injury, that interferes with the blood circulation to tissues such as a bruise or an infarct, will create an environment in which *Cl. chauvoei*, *Cl. septicum* and *Cl. sordellii*

- muscle-destroying clostridia and cause blackleg, malignant edema, (gas gangrene)
- Black leg characterized by
 - t swelling,
 - collecting of fluids in the tissues,
 - sometimes production of gas in the muscle tissues surrounding the area of infection (the aroma of tissues infected with chauvoei is that of rancid butter)
 - Affected animals are usually lame and depressed,
 - have an elevated body temperature early which falls below normal as the diseases progress
- 1. Blackleg
 - a. Clostridium chauvoei: etiological agent
 - i. Found naturally in the GI tract of cattle
 - ii. Will remain viable in the soil for years
- 2. Malignant Edema
 - a. Acute and generally fatal toxemia of cattle, horses, sheep and goats.
 - b. Caused by Clostridium septicum:
 - i. Often accompanied with other clostridial species
 - ii. Occurs worldwide
 - c. Source of infection is usually contaminated wounds containing devitalized tissue, soil etc
- 3. Histotoxic: Liver Disease:
 - Liver Disease caused by two clostridia,
 1. Clostridium novyi (BLACK DISEASE)
 2. Clostridium haemolyticum (RED WATER)
 - toxins are produced while the bacteria are multiplying.
 - The toxins expand the area of liver damage
 - are absorbed into the bloodstream, through which they reach and damage vital organs

Enterotoxigenic (Gut) Group of Clostridia (A,C,D)

- The gastrointestinal (gut) group of clostridia consists of three types of Clostridium perfringens which cause enterotoxaemia disease.
- As a group the Clostridial perfringens have been found in the intestinal tracts of most animals and are worldwide in distribution
- In Feedlot cattle Clostridium perfringens type C&D is associated with sudden death.
 - very difficult to accurately diagnose
 - often over diagnosed. When nothing else is evident sudden death is a crutch diagnosis. Avoid it.
 - Is C&D Perfringens is considered a normal inhabitant of the GI tract in fed cattle
 - Necropsy lesion supposedly cyanotic to red color, congested small intestine. This color is also considered normal after death.

- Diseases due to the enterotoxic group appear following the intake of feeds high in soluble carbohydrates and/or when the diet is changed suddenly
- Excess ingestion of feed brings about a change in the rumen organisms with a subsequent acidosis. In addition, partially fermented grain is allowed to enter the small intestines mainly in the form of starch granules. This creates an environment favoring rapid multiplication of the organism. Acidosis worsens, the motility of the rumen and the intestinal tract decreases. This allows the toxin produced by the multiplying Type D bacteria to accumulate in the forward part of the small intestine where it eventually escapes into the blood stream and the animal dies acutely.
- Type C Clostridial Perfringens is activated under conditions in the small intestines produced by large quantities of milk, reduced intestinal motility (Young Calves)
- Type B not recognized the US
- Recent work indicates that C&D may not be associated with sudden death at all and only type A is involved.
- Deaths from diseases of the gut group occur suddenly, usually before clinical signs are seen

Neurotoxic (affect the neurological system) Clostridia

1. Clostridium botulinum: Botulism
 - Used to be major problem (home canning)
 - Spores not killed by boiling, survive inadequate pressure sterilization
 - Spores germinate in foods, vegetative cells produce toxin
2. Clostridium tetani: Tetanus

Tetanus Disease Progression

 1. spores contaminate wound etc germinate,
 2. vegetative cells release toxin on lysis
 3. incubation period: days to weeks
 - shorter incubation periods, usually higher mortality
 4. toxin passes retrograde along nerve fibers, ~20 mm per day, fixes rapidly to nerve tissue
 5. - main target: anterior horn cells of spinal cord, brain stem
 6. trismus (lockjaw) followed by general rigidity
 - spasms of muscles to trunk and limbs
 - death by interference with mechanics of respiration usually without delirium

Tetanus Protection

- Tetanus
 - Vaccination against tetanus requires a separate vaccine
 - Utilized most often when banding calves, and large bulls
 - Can be a problem in feedlot cattle

- One dose of vaccine is usually given. For a large number of animals to be immune 2 doses would be preferred.
- Tetanus antitoxin can be given and usually is, to protect cattle for short periods of time.

With the exception of *Cl. chauvoei* (blackleg), two doses of vaccine are required to stimulate resistance against all clostridial bacteria because a high level of antibodies must be immediately available to combat the active bacteria and/or their toxins

- Animals being vaccinated against any of the clostridial diseases for the first time should receive two doses three to four weeks apart.
 - Animals vaccinated under three months of age should be revaccinated at weaning or at four to six months of age.

Organisms and disease conditions

- Blackleg, (*Chauvoei*)
- Malignant Edema, (septicum) gas gangrene
- Black Disease, (*Novyi*)
- Red Water Disease, (*Haemolyticum*)
- Enterotoxemia (*Perfringens*)
- Tetanus (*Tetani*)
- Botulism (*Botulinum*)