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Lecture title: Colibacillosis of Newborn Calves, Lambs, Kids, and Foals

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Summary:

ETIOLOGY

Pathogenic serotypes of *E. coli*, including the following:

1- Enterotoxigenic *E. coli* (ETEC):

● The most common pathogen that causes diarrhea.

● Colonizes in the intestinal mucosa.

● Produces enterotoxins.

2- Enteropathogenic *E. coli* (EPEC):

● Colonizes in the small intestine.

● does not produce toxins and seldom invade the intestinal mucosa.

● Attaches tightly to the epithelial cells of the villus and causes and effacing lesions.

3- Enterohemorrhagic *E. coli* (EHEC):

♣ Causes attaching and effacing lesions.

♣ Produces toxins known as:

• Shiga-toxin —Shiga-toxin-producing *E. coli* (STEC): because it is similar to the one produced by *Shigella dysenteriae* type I.

• Verotoxin —verocytoxin producing *E. coli* (VTEC): because it is detected with the Vero cell-toxicity test

♣ Shiga toxins may not cause anything or mild diarrhea to severe hemorrhagic colitis.

♣ EHEC are highly prevalent in cattle, but do not cause clinical disease, or can be associated with diarrhea in calves.

4- Necrotoxigenic *E. coli* (NTEC):

♣ Produces cytotoxic necrotizing factor (CNF)1 or 2.

♣ Restricted to ruminants, particularly calves and lambs with diarrhea and septicemia.

5- Entero-Invasive *E. coli*:

♣ Invasive strains, cause septicemia in calves, piglets, and lambs.

♣ Their powerful endotoxins cause endotoxic shock, with a high case fatality rate.

EPIDEMIOLOGY

Animal Risk Factors:

o Occurs in calves, mainly during the **first few days of life**, rarely in older calves, and ***never*** in adults.

o Coliform septicemia is most common in calves during the first 4 days of life.

o Colostrum deprivation.

♣ Transfer of maternal immunoglobulin to calves depends on three successive processes:

1- Formation of colostrum with a high concentration of immunoglobulin by the dam.

2- Ingestion of an adequate volume of colostrum by the calf.

3- Efficient absorption of colostral immunoglobulin by the calf.

ϖ Colostral immunoglobulin is absorbed for up to 24 hours after birth in calves.

♣ maximum efficiency of absorption occurs during the first 6 to 12 hours after birth, decreases rapidly from 12 to 24 hours after birth.

● **Environmental and Management Risk Factors**:

o Overcrowding.

o Poor housing and hygienic practices.

o Adverse climatic conditions (cold, wet, and windy winter & hot and dry summer).

● **Pathogen Risk Factors**

o Virulence factors of E. coli include:

♣ Pili (fimbriae): allow bacteria to adhere to intestinal villous epithelial cells.

♣ Enterotoxins (exotoxins): damage the intestinal epithelium.

♣ Endotoxins: results in shock and rapid death.

♣ capsules: involved in adhesion and colonization.

Pathogenesis:

- The factors important in the pathogenesis of colibacillosis are:

o The species of the animal.

o the age of the animal.

o The immune status of the animal

o The virulence factors of the pathogen.

- Diarrhea, dehydration, metabolic acidosis, bacteremia, and septicemia are the major pathogenetic events in the various forms of colibacillosis.

● **Septicemic Colibacillosis (Coliform Septicemia):**

- Invasive strains of *E. coli* invade the tissues and systemic circulation via the intestinal lumen
- →Release of endotoxin
- → Hypothermia, decreased systemic blood pressure, tachycardia and decreased cardiac output, changes in WBC counts, alterations in blood coagulation, hyperglycemia followed by hypoglycemia, and depletion of liver glycogen.

● **Enteric Colibacillosis:**

- Adhering of the bacteria to enterocytes and colonizing in the intestinal mucosa →
- Producing of enterotoxins → increases intestinal chloride secretion →hypersecretion of electrolytes and water into the small intestine more than the absorptive capacity of the intestinal mucosa (without causing significant morphologic damage or invading tissue)
- →varying degrees of diarrhea, dehydration, electrolyte imbalances
- acidemia, circulatory failure, shock, and death.

● **Enterohemorrhagic Colibacillosis:**

- Attaching and effacing enteropathogenic E. coli →
- adhere to the surface of the enterocytes of the large intestine (without producing enterotoxin)
- →Affected calves pass bright red blood in the diarrheic feces.

CLINICAL FINDINGS

- A- Weakness and collapse (coliform septicemia).
- Diarrhea and dehydration.
- Colibacillosis in lambs is commonly septicemic and peracute. (Two age groups appear to be susceptible: lambs 1 to 2 days of age and lambs 3 to 8 weeks old.)
- Hemorrhagic enteritis is a fatal syndrome characterized by anorexia, fever, diarrhea with mucus containing feces that become bloody in the later stages, and hemorrhagic diathesis on the conjunctivae and mucous membranes of the mouth and nose.
- Complications of disease: meningitis or polyarthritis.
- Complications occurs in animals that recover from septicemia and later develop lesions because of local infection of other organs at varying periods of time.

Clinical pathology:

- • Isolation of organism from feces or blood.
- • Hematology and serum biochemistry to evaluate inflammation and acid–base and electrolyte imbalance.

Differential diagnosis:

- 1- **Salmonellosis**: Calves are usually affected at ***six days of age*** or older. This age corresponds very closely to the age of the coronavirus infection. Clinical signs associated with salmonella infection include ***diarrhea, blood and fibri*n** in the feces, depression, and elevated temperature. The disease is more severe in young or debilitated calves.

- 2- **Rotavirus:** can cause scours in calves within ***24 hours*** of birth. However, when the infection- is first introduced into the herd, it can affect calves up to 30 days of age or older. Infected calves are severely depressed. There may be a drooling of saliva and profuse watery diarrhea. The feces will vary in color from yellow to green. The reo-like virus infection alone causes no diagnostic gross lesions in the intestine, but there is an increased volume of fluid in both the small and large intestine.

- 3- **Bovine Virus Diarrhea:** The virus of bovine virus diarrhea can cause diarrhea and death in *young calves*. Diarrhea begins two to three days after exposure and may persist for quite a long time. Ulcers on the tongue, lips, and in the mouth are the usual lesions that can be found in the live calf.

- 4- **Coronavirus:** Diarrhea caused by coronavirus occurs in calves that are ***over five days*** of age. At the start of the infection in herd, calves up to ***six weeks*** of age may scour. These calves are not as depressed as those infected with rotavirus. Initially, the fecal material may have the same appearance as that caused by rotavirus. As the calf continues to scour for several hours, the fecal material may contain clear mucus that resembles the white of an egg. Diarrhea may continue for several days. Mortality from coronavirus scours ranges from 1 to 25%.
- 5- **Coccidiosis**: Coccidiosis is caused by one-celled parasites that invade the intestinal tract of animals. There are many species of coccidia. *Eimeria zurnii* and *Eimeria bovis* are usually associated with clinical infections in cattle. Coccidiosis has been observed in calves three weeks of age and older, usually following stress, poor sanitation, overcrowding or sudden changes of feed. It often occurs in calves of 7 to 14 days after they are moved from the calving lots onto pasture. Occasionally, clinical coccidiosis will be present with bleeding and very few parasites in the fecal material. Death may occur during the acute period or later from secondary complications.
- 6- **Cryptosporidium**: Cryptosporidium is a protozoan parasite that is much smaller than coccidia. It has the ability to adhere to the cells that line the small intestine and to damage the microvilli. Several reports from researchers and diagnosticians have associated cryptosporidium with outbreaks of calf scours. As a rule, cryptosporidium is detected in combination with coronavirus, rotavirus, and/or E. coli.
- 7- **Nutritional cause**: Nutritional in calves can be caused by anything that disrupts this normal habit. A storm, strong wind, or the mother going off hunting for new grass disrupts the normal nursing pattern. When the hungry calf does get an opportunity to nurse, the cow's udder may contain more milk than normal and the calf may **overeat** resulting in a nutritional scour. Erratic nursing patterns may also be conducive to enterotoxemia. Nutritional scours is usually white scours caused by undigested milk passing through the intestinal tract. This type of diarrhea usually presents little problem in treatment. If the affected calves are still active and alert, no treatment is required. If the calf becomes depressed or fails to nurse, it should be treated.

- ***TREATMENT***:
- ● Treatment requires aggressive **antimicrobial,** fluid and anti-inflammatory therapy. Although blood cultures are recommended to retrospectively confirm the diagnosis, antimicrobial therapy must be initiated immediately in any animal suspected of being

septic. Because there is no time for sensitivity testing, the initial choice should be a bactericidal drug that has a high probability of efficacy against gram negative organisms.

- ● Administration IV and P.O of large volumes of balanced electrolyte solutions over several hours is essential to correct hypovolemia and assure adequate peripheral tissue perfusion; fluids should include glucose saline (5%-0.9%) to correct hypoglycemia and electrolyte fluid must be used to correct the electrolyte imbalance (ringer sol.).
- ● The beneficial effect of **NSAIDs** has been attributed to their anti-inflammatory, antipyretic, and analgesic properties. **Glucocorticoids** have also been proposed to treat septicemia, although their benefits for treatment of sepsis are less well established.
- ● Intestinal protectant such as pectin and kaolin.
- ● Probiotics have beneficial effects on health of the host, such as lactobacillus, enterococcus and bifedobacterium.(live microorganism improve health