Diagnosis and Treatment of Life-Threatening Neonatal Diseases

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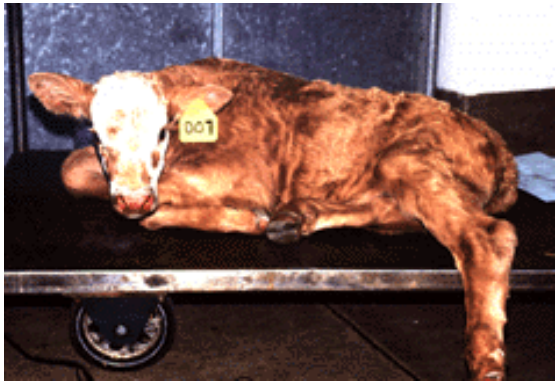
Common Neonatal Diseases

- **Failure of passive transfer (FPT)**
- **Septicemia**
- **Diarrhea**
- **Enterotoxemia**
- **Pneumonia**
- **Neonatal maladjustment syndrome**
  - Difficult calving
  - Hypoxemia *in utero*
- **Viral diseases that do not cause diarrhea**
- **Congenital anomalies**



Failure of Passive Transfer: Cause

- **Failure to ingest colostrum**
  - Musculoskeletal abnormalities
    - **Flexure deformities**
    - **Calving injury**
    - **Cow steps on the calf**
  - Neonatal maladjustment syndrome
    - **Hypoxemia at birth**
      - May be related to a difficult birth
  - Nutritional deficiencies resulting in weakness at birth
  - Neonatal septicemia

- **Ingestion of poor quality colostrum**
  - The quality of colostrum can be improved with good maternal care prior to calving
  - Adequate nutrition
  - Vaccination 30 – 60 days prior to calving will increase the antibody concentration in the colostrum
  - First calf heifers may not produce enough colostrum

Failure of Passive Transfer

- FPT is caused by a calves inability to ingest adequate colostrum or because the colostrum is of poor quality
- FPT is a risk factor for other infectious diseases
- By ensuring that colostrum is ingested and that it is of good quality will reduce the likelihood that a calf will become infected with an infectious pathogen
- Ingestion of adequate good quality colostrum is the single most important husbandry practices to support calf health
- FPT can be diagnosed by measuring the concentration of serum proteins

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Treatment of FPT in Cattle

- **Treat the primary problem**
  - Difficult birthing
  - Sepsis
  - Neonatal maladjustment syndrome
  - Prematurity
- **Early diagnosis of FPT can be treated with colostrum administered orally**
- **Diagnosis of FPT in cattle beyond 12 - 24 hours of age can be treated with a whole blood transfusion**
  - The dam and/or an unrelated bovid is a suitable donor
  - It is not necessary to cross match cattle for one transfusion
    - **More than one transfusion requires cross-matching**
  - ***Horses and small ruminants require cross-matching***

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Neonatal Septicemia: Cause

- **FPT is a common risk factor associated with neonatal septicemia**
- **Calves that do not ingest adequate colostrum or poor quality colostrum are at risk of developing septicemia**
- **Urachus remains patent and ascending infection results**
- **Calves can become septic *in utero***
  - Maternal placentitis
- **Most cases of septicemia are caused by gram negative bacteria**
  - Several studies have shown that gram negative bacteria account for approximately 80 percent of bacterial isolates from septic ruminants
    - ***E. coli* is the most common bacteria isolated**
  - Gram positive organisms account for approximately 20 percent of bacterial isolates

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Neonatal Septicemia: Clinical Signs

- Depression
- Lack of a suckle reflex
- Anorexia
- Dehydration
- Anterior uveitis and/or iritis
- Swollen painful joints
- Swollen painful urachus
- Petechiae
- Cold extremities
- Diarrhea

Neonatal Septicemia: Treatment

- **Supportive care**
  - Fluid replacement
    - **Administration of dextrose containing solutions is usually warranted due to hypoglycemia**
  - Fluid maintenance
  - Nutritional support
    - **Feed through orogastric intubation**
      - Milk the dam and feed to the calf
      - Milk replacer
  - Anti-inflammatory agents
    - **Flunixin meglamin (Banamine®)**
      - 1.1 to 2.2 mg/kg (IV, SQ, IM)
        - **One dose**
      - In adults residues can persist for up to 30 days – no data on neonates
    - **Aspirin**
      - 50 - 100 mg/kg orally

Neonatal Septicemia: Treatment

- **Supportive care**
  - Antimicrobial therapy
    - **Use broad spectrum antimicrobial agents**
      - Emphasis on gram negative coverage
      - Often require long-term treatment of 5 to 7 days
    - **Antimicrobials with gram negative spectrum of activity**
      - Gentamicin (3mg/kg every 12 hours or 6.6 mg/kg every 24 hours – intramuscularly or intravenously for 5 to 7 days)
        - **Long meat withdrawal time – 18 months**
        - **Accumulates in the kidneys**
        - **Used in combination with an antimicrobials that target gram positive agents**
        - **Must ensure adequate hydration or can cause renal failure**
      - Amikacin (7 – 10 mg//kg every 12 hours - intravenously or intramuscularly for 5 to 7 days)
        - **Long meat withdrawal times – same as gentamicin**
        - **Should be used with an agent that targets gram positive agents**
        - **Must ensure adequate hydration or can cause renal failure**
        - **Expensive**

Neonatal Septicemia: Treatment

- **Supportive care**
  - Antimicrobial therapy
    - **Antimicrobials with gram negative and gram positive spectrum of activity**

      - Ceftiofur (1 to 5 mg/kg twice daily – intravenously or intramuscularly for 5 to 7 days)
        - **Short withdrawal time – 2 – 4 days**
        - **Safe for use in neonates**
      - Ampicillin (10 mg/kg every 12 hours intravenously or intramuscularly for 5 to 7 days)
        - **Long meat withdrawal times – especially important for human consumption due to penicillin allergies**
        - **Weak gram negative coverage mostly gram positive - should be used in combination with an agent that has gram negative coverage**
        - **Safe for use in neonates**
  - Antimicrobials should be administered for the full 5 to 7 days

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Neonatal Diarrhea

- **Neonatal diarrhea is commonly caused by infectious pathogens**
  - *E. coli*
    - **Calves less than a week are usually affected by enterotoxigenic E. coli strains**
  - Rotavirus
    - **Calves of all ages are susceptible to rotavirus**
  - Coronavirus
    - **Calves of all ages are susceptible**
  - Salmonella
    - **Calves of all ages are susceptible**
  - *Cryptosporidium*

- ***Successful calf rearing and a low incidence of diarrhea is based on good management***

Etiological Agents

- **Diarrhea can be a result of increased secretions or decreased absorption**
- **Enterotoxigenic *E.coli*, *Salmonella sp*., and *Campylobacter sp*. cause diarrhea by producing toxins that bind to the intestinal epithelium to increase intestinal secretions**
- **Rotavirus, Corona virus, and *Cryptosporidium* typically destroy the intestinal epithelium and impair fluid absorption**
  - Rotavirus may also secrete a toxin that increases intestinal secretions

Neonatal Diarrhea: Clinical Signs

- **Diarrhea**
  - May or may not have blood
- **Fever may or may not be present**
  - Depends on etiological agent and whether or not systemic infection exists
- **Can occur with septicemia**
  - Symptoms associated with septicemia
- **Calves with enterotoxogenic *E. coli* diarrhea may have profound depression due to metabolic acidosis**
  - Hyperkalemia may cause arrhythmias
  - Depression is usually present with diarrhea associated with other etiological agents but may not be as severe
- **Poor appetite**
- **Dehydration**

Enterotoxogenic *E.coli* Diarrhea

- **Enterotoxigenic E. coli and other bacterial pathogens bind receptors on the intestinal epithelium, which induces the secretion of sodium, potassium, and chloride into the gut lumen**
  - Water follows the electrolytes into the lumen and induce diarrhea
  - Electrolyte secretion can be severe enough to alter the acid base status
    - **Calves can develop a severe metabolic acidosis because of the rapid sodium loss**
    - **Because of the acidosis, large intracellular stores of potassium are pushed out of the cell and can result in hyperkalemia**
      - Whole body potassium has not been affected – it is a shift from intracellular to extracellular compartments
    - **Hyperkalemia can adversely affect the function of the heart causing bradycardia and atrial standstill**
      - Bradycardia in the face of dehydration is an indicator of enterotoxigenic E.coli
      - Sodium bacarbonate and dextrose therapy will rapidly reverse hyperkalemia and metabolic acidosis

Neonatal Diarrhea: Treatment

- **Supportive care**
  - Fluid replacement
    - **Oral versus intravenous**
  - Fluid maintenance
    - **Oral versus intravenous**
  - Nutritional support
    - **Feed through orogastric intubation if tolerant of milk**
      - Rota and corona virus infection disrupts lactase producing villous tips
        - **Milk is poorly tolerated**
        - **Yoghurt with live cultures can help support the re-establishment of intestinal flora**
  - Antimicrobial therapy
    - **Only indicated with systemic signs**

Fluid Therapy to Treat Enterotoxigenic *E.coli*

- **Calves with enterotoxigenic *E.coli* may require correction of electrolyte abnormalities and metabolic acidosis**
- **If severe depression is present, correction of acid base abnormalities may be required**
- **Sodium bicarbonate can be supplemented in intravenous fluids or orally**
- **For intravenous use - 13 grams of sodium bicarbonate (baking soda) per liter of water makes an isotonic solution of 156 mmol/L**
  - This can be added to a liter of sterile water
  - If no sterile water exists it is best to put into 5% dextrose solution
    - **The solution will be hypertonic and can worsen dehydration**
    - **Administer in two liters**
- **For oral administration – 2-4 tablespoons of baking soda can be added to 2 liters of water and administered by orogastric intubation**
  - Do not mix alkalizing solution with milk – it will disrupt clot formation

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Enterotoxemia: Cause

- **Enterotoxemia is caused by *Clostridium perfringens* type C**
  - *C. perfringens* type C produces alpha hemolytic toxin and the beta hemolytic toxin
- **The organism is acquired from the environment in the first few days of life**
- **Adults can be asymptomatic shedders**
  - It is not considered a normal commensal like type A

Enterotoxemia: Clinical Signs

- **The clinical signs are consistent with necrotic enteritis and diarrhea**
  - Diarrhea varies in consistency and color
  - Streaks of necrotic mucosa may be present
  - Abdominal pain and bloating, especially on the right side
  - Depression and lethargy
  - Anorexia
  - Dehydration
- **Some calves may die before diarrhea develops**
- **Morbidity and mortality are high**

Enterotoxemia: Treatment

- **Supportive care is required**
  - Fluid therapy
  - Nutritional support
  - Anti-inflammatory
- **Systemic antimicrobial therapy is required if systemic systems exists**
- **Oral penicillin has been used but success has not be documented scientifically**
- **Morbidity and mortality are high and treatment is usually unsuccessful**
- **Prevention through vaccination is the best therapy**

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Summary

- **Many diseases of the neonate present similarly**
- **Treatment if often very similar**
- **Supportive care and appropriate antimicrobial therapy are the key to successful management of neonatal diseases**
- **Veterinarians should educate farmers about proper maternal and calf husbandry practices to improve calf survival and minimize infectious diseases**
  - Vaccinations
  - Nutrition
  - Colostrum