VMS 361 Agricultural Animal Health

Bovine Health Section
Calf Scours

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Scheme for today:
• What will you need 5 years from now?
  – What are common misconceptions?
  – What are major pitfalls to avoid?
  – What are the fundamentals of infectious disease control?

Nuts & Bolts
Using Calf Scours as an example

Calf Scours:
• How big of a problem is it?
• What is it and how it “works”
• What I recommend to:
  – Treat a calf with the problem
  – Prevent the problem from occurring again

Reading Assignment:
– Basic Concepts for Cow-Calf Herd Health Programs
  http://www.vetmed.wsu.edu/courses-jmgay/FDUCowCalfHH.htm

Calf Scour Prequiz

5 short answers:
1. What % of pre-weaning calf deaths are due to calf scours?
2. What “bug” is the most important cause of calf scours?
3. Where do the “bugs” come from?
4. What is the most important treatment?
5. What is a common but least important treatment?

How big of a problem is calf scours?

<table>
<thead>
<tr>
<th>% of Annual Deaths</th>
<th>Beef Calves</th>
<th>Beef Cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dystocia</td>
<td>33%</td>
<td>26%</td>
</tr>
<tr>
<td>Calf Scours</td>
<td>17%</td>
<td></td>
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<tr>
<td>Calf Pneumonia</td>
<td>10%</td>
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From USDA NAMMS Beef Cow-calf Health and Health Management Practices
**Calf Mortality** - Beef and Dairy Herd NAHMS Studies

- Total Calf Mortality (death) prior to weaning
  - 6% Beef
  - 11% Dairy
- Scours as reason for Mortality:
  - 18% Beef
  - 60% Dairy

Diarrhea is the disruption of normal gut physiology

- Body water cycles in and out of intestinal tract as part of digestion
  - 25% of body water cycles thru intestinal tract daily
- Two forms of disruption:
  - Normal secretion into intestine, reduced (malabsorption) back out
    - Most infectious diarrheal agents
  - Excess secretion (hypersecretion) into intestine, overloaded reabsorption back out
    - E. coli K99, cholera

Diarrhea causes dehydration and electrolyte imbalance

- Body water loss => Dehydration
  - Skin “tents”, sticky mouth, cold limbs and ears, sunken eyes
  - Urine output drops and stops if severe
- Body electrolyte (salts) loss and imbalance
  - Affects heart and skeletal muscle function
    - If shifts are severe enough, heart stops
  - Depresses CNS

Balanced intake and output are essential to normal fluid balance

Diarrhea: Loss of body water & salts (electrolytes)
Malabsorption causes diarrheal imbalance

\[ \text{Intestine} \rightarrow \text{Body Fluids} \rightarrow \text{Shrinking Body Fluid Volume} \]

Hypersecretion causes diarrheal imbalance

\[ \text{Intestine} \rightarrow \text{Body Fluids} \rightarrow \text{Shrinking Body Fluid Volume} \]

The most important treatment is replacement fluid

- **Detect** scouring calf before fluid loss becomes profound so oral replacement works
- **Replace** both lost body fluid (water) and electrolytes (salts) in **large enough quantity often enough** that loss does not become profound

**Most Important Treatment?**

**Oral rehydration solutions (ORS)** have 4 key ingredients

- Dextrose (glucose) – for energy
- Glycine – for absorption
- Salts - potassium chloride, salt, dicalcium phosphate, magnesium sulfate
- Sodium bicarbonate - buffer

2.3% glycine and 44 grams dextrose (glucose)

- "high energy" label – required to fuel absorption
- Caution: Still only ½ the energy of milk!

**Use high energy electrolytes with glycine**

- Feeding only fluids too long leads to death by starvation / hypothermia
Use esophageal feeder to quickly transfer fluids

Must be inserted carefully and sanitized between calves

Least Important (but all too common) Treatment?

For several reasons, the least important treatment is an antibiotic!

- Agents that cause calf scours are:
  - Viruses or protozoa that antibiotics have no effect upon
  - Bacteria that are usually resistant to the OTC antibiotics
- Antibiotics, particularly OTC (over the counter) oral antibiotics, are usually ineffective!
  - Antibiotics in scour boluses
  - Antibiotic-containing milk replacer
  - Antibiotic-containing starters

To be successful, treatment must be early!

Determine how to treat a scouring calf by classifying it into one of three categories

- **Degree of dehydration**
  - Early  < 5% Body Wt
  - Moderate  7% Body Wt
  - Severe  > 9% Body Wt
- **5 classification components - LOBES:**
  - Limbs
  - Oral membranes
  - Body Position
  - Eyes
  - Skin

Key to successful treatment!

Early Fluid Loss (<5% BW)

- Calf is:
  - Limbs - warm
  - Oral membranes - moist
  - Body position - bright, standing
  - Eyes - bright
  - Skin - “tents” for < 4 seconds
- Calf will suckle electrolyte solution from a bottle
- Leave calf on milk and add several 2 quart electrolyte feedings per day until scours slow
  - Reason: If calf doesn’t have adequate fat reserves, feed removal can cause death by starvation/hypothermia before scours stop
Dehydration Sign – skin "tenting" pinch test

Loose skin of neck, chest

Eyelid

Moderate Fluid Loss (7% BW)

- Calf is:
  - Limbs - cold
  - Oral membranes - warm but sticky
  - Body position - dull, lying down but upright
  - Eyes - sunken slightly with a slight gap
  - Skin - "tents" for 5 secs

- RX: to survive 1/2 gallon of warm special “high energy” electrolyte solution (Enterolyte HE) by esophageal feeder twice several hours apart
- Move to warm area where calf can be monitored

Severe Fluid Loss (>9% BW)

- Calf is:
  - Limbs - cold
  - Oral membranes - cold, pale and dry to touch
  - Body position - lying flat in a coma
  - Eyes - deeply sunken with a big gap
  - Skin - stays “tented”

- RX: Only 1 gallon of special electrolyte fluids by IV drip will save the calf
  - SQ and oral fluids won’t be absorbed because circulation is too poor
  - Unless you can do IV’s, take calf to veterinary clinic

IV drip into jugular vein

Fluid volume must replace loss and keep up with continuing losses

- Enough balanced electrolyte fluids must be given to:
  - Replace % of body weight (BW) lost
  - Meet maintenance requirements (50 ml / kg BW per day)
  - Keep up with ongoing loss of 1 to 4 Liter per day in the diarrhea

- For a 7% dehydrated 80 lb calf, this is 6 to 9 quarts of electrolyte solution the first day
  - 1 Enterolyte H.E. pack is only 2 quarts! -> 4 packages

Commonest Infectious Diarrheal Agents

- Bacteria
  - Escherichia coli (E. coli) strains
  - Salmonella serotypes dublin, typhimurium, newport and others

- Viruses
  - Rotavirus
  - Coronavirus

- Protozoa
  - Cryptosporidia
  - Coccidia
Key *E. coli* characteristics

- Normal gut flora of all mammals so *E. coli* is ubiquitous (everywhere)
- Three disease forms:
  - Colisepticemia - any strain
  - Enterotoxigenic - specific strains
  - Enteropathogenic - specific strains
- A most common cause of calf death
- OTC antibiotics are usually not effective
- Some very effective ones are illegal to use!

Baytril cannot be used off-label, even by veterinarians

“Federal law prohibits the extra-label use of this drug in food-producing animals”

Colisepticemia is caused by any *E. coli*

- Spreads through calf’s body to cause abscesses in the brain, eyes, kidneys, and joints
- Occurs when calf ingests manure, mud or other material before or along with colostrum
- Virtually impossible to treat successfully
- Prevented by:
  - calving in clean, dry areas
  - cows having clean udders
  - Harvesting colostrum cleanly and keeping refrigerated or frozen
  - feeding 4 qts of high quality colostrum within 4 hours of birth

E. coli are everywhere in manure-contaminated mud!

Bad conditions > First mouthful is *E. coli*

Low density, no mud > Excellent conditions!
High density, lots of manure > Very poor conditions!

Calving on Winter Feedground

Enterotoxigenic *E. coli* (ETEC)

- **Specific strain (K99)** attaches to intestinal cells and causes a hypersecretory diarrhea
  - Toxin turns on cell’s fluid pump
- Almost the only diarrhea that **occurs within first 3 days of life**, often in first day
  - Calf can die of dehydration **before diarrhea appears**!
- Prevented by feeding colostrum containing K99 antibodies
- Cow vaccine available

Enteropathogenic *E. coli* (EPEC)

- *E. coli* strains attach to gut wall and secrete toxins
- Cause both excess secretion and malabsorption as well as general systemic effects on the calf
- No vaccine

Corona & Rotaviral Diarrhea

- Virus kills cells of intestinal villi, causing malabsorption diarrhea
- Calf begins shedding $10^{11}$ virus per gram of feces 3 days after infection
- Carrier cows continually shed low numbers of virus
- Virus survives weeks in the environment
- Vaccines available
- Antibiotics are ineffective (virus)

3 Keys to Management
Microscopic cross-section of normal intestinal villi

Cross-section of virus-infected villi (green)

Normal villi
Blunted villi

www.merricks.com/tech_electrolyte_milk.htm

Salmonella Diarrhea

- Calves can shed it in feces, urine, saliva and nasal secretions, contaminating everything they touch and everything that touches them (hands, esophageal feeders, nipples, ...)
- Salmonella survive in the environment for months
  Only direct sunlight kills it in the environment
- Usually resistant to OTC antibiotics

For Salmonella, the major transmission cycle is fecal-oral and fecal exposure is the major risk

Salmonella can be transmitted by virtually every body orifice

Note that the exceptions provide major traps for the unwary

Many are unaware of the other transmission and exposure risks
Salmonella Diarrhea

- Antibiotics:
  - Depress the normal bacterial flora, making the animal more susceptible to infection and prolonging the diarrhea
  - May be required if infection is systemic; use injectable
- Vaccines of questionable effectiveness
- This is a zoonotic disease, meaning that humans get it!
  - Practice careful personal sanitation with hands, boots, clothes

Cryptosporidial Diarrhea

- Ubiquitous organism that survives for months in the right environment
- No practical antibiotics are effective
- Not killed by most disinfectants
  - Killed by complete drying
- This is a zoonotic disease, particularly for the immunocompromised

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Given that most diarrheal agents:

- Are ubiquitous (holoendemic)
- Survive well in the environment
- Aren’t curable with drugs
- Establish carrier states in herdmates
- Often co-evolved with their bovine host

How do you reduce / prevent disease?
Production systems are dynamic relationships between animal hosts, infectious agents and their environments. When disease problems occur:

- After asking “what’s wrong?”, ask “how did the system get here?”
- Ask “What changed?”
  - A change in one point of the system often leads to unintended consequences elsewhere
- “A common error is to define the problem not by what’s happening in the system but by the lack of our favorite solution” (D Meadows)

Apply the general principles to the production system:

- Maximize the calf’s natural resistance and acquired immunity
- Delay and minimize the infectious dose the calf is exposed to
  - Because these agents are ubiquitous, calf must eventually acquire the infection and develop an active immunity

Principles for reducing pre-calving exposure - Beef

- Move cows and heifers to separate calving areas several weeks before calving
  - Skin and hair of cows on winter feed and bed ground have infectious agents shed by carrier cows
  - Heifers generally have poorer colostrum
  - Heifers need more calving supervision
  - To avoid “sophomore slump”, heifers should be bred to calve one month ahead of cows

Principles for reducing post-calving exposure - Beef

- 1 Day after calving, move pair to large pasture area to spread out
  - Exposed calf takes about 3 days to begin shedding agent in large numbers
- If scours develops in a group, leave all of that group in place but turn out new pairs to a new pasture
  - Remember the “Iceberg Principle!” Many calves will be subclinical shedders!

Beef Calving System

"The Sandhills Calving System"

- Developed in Nebraska by Dr. David Smith and colleagues

Reducing post-calving exposure - Dairy

- Within first day, move calf to a cleaned individual hutch that isolates the calf from contact with and the air space of other calves
- Sanitize anything that contacts the mouth of a calf prior to that contact (nipples, esophageal feeders, pill guns, hands)
Reducing post-calving exposure - Dairy

- After weaning from milk, group by age in progressively larger groups
  - 1 to 7 to 14 to 28
- **DO NOT** hold back calves on the basis of small size; these are often carrier animals that will infect younger groups
  - Group poor doers separately

Flies transmit many disease agents

- What do you suppose the calf ingests besides water when drinking?

Damp straw bedding is a fantastic fly incubator

- Parasitic wasp raisers grow their flies in damp straw!

The House Fly *Musca domestica*

- Mouth Parts
- ½ of "fly spots" are regurgitation of previous meal
- Puparium (Pupal Case)

Colostrum cooling on the parlor floor

- Don’t overlook the cycles of the vermin (flies, rodents, birds)!

Summer time bedding system
Most of all, avoid PPM!

Bad Management overwhelms the Best Vaccine every time!