Managing the Scouring Calf

Hans Coetzee BVSc, Cert CHP, PhD, DACVCP
Iowa State University

Calf Scour Myths

- Scouring calves need oral antibiotics
- Stop feeding milk to scouring calves

Structure of this Session:-
I/ What is Diarrhea ?
II/ Classification of Fluid Loss
III/ Causative Organisms
IV/ Consequences of Fluid Loss
V/ Treatment and Prevention
“Calf Scours”

“FAILURE OF NET INTESTINAL UPTAKE OF WATER AND SODIUM SUCH THAT THE COLON IS OVERWHELMED”

Basic Anatomy

RUMEN
ABOMASUM
SMALL INTESTINE
COLON

Normal Fluid And Electrolyte Flux

FLUX OF FLUIDS = 90 Litres/ day OR 24 gallons/ day
II/ Classification of Fluid Loss

1/ HYPERSECRETORY DIARRHEA-
   - Increased SECRETION of fluid from gut cells.
   - SECRETION > RE-ABSORPTION

Example:-
E.coli Scours

Classification of Fluid Loss

2/ MALABSORPTION DIARRHEA-
   - Damage to GUT LINING reduces ability to ABSORB FOOD
   - Undigested food in the colon → hyper-osmotic
   - Fluid drawn into the colon
Example:
Rota, Corona, Cryptosporidium

Clinical Evaluation

- Fecal pH
  - Alkaline – secretory
  - Acid - malabsorptive

III/ Causative Organisms

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th>AGE (days)</th>
<th>INCIDENCE (UK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>&lt; 5 days</td>
<td>5 %</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>5 to 15 days</td>
<td>46 %</td>
</tr>
<tr>
<td>Coronavirus</td>
<td>5 to 21 days</td>
<td>11 %</td>
</tr>
<tr>
<td>Cryptosporidium</td>
<td>5 to 35 days</td>
<td>24%</td>
</tr>
<tr>
<td>Salmonella spp.</td>
<td>5 to 42 days</td>
<td>7 %</td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
<td>7%</td>
</tr>
</tbody>
</table>
Presence of Organism does not always equate with disease

- "Pathogens" are present in healthy animals as well as diseased animals
- Organisms may be shed intermittently
- Serological screening of adult animals suggests that almost all animals have been exposed at some stage
- Many scour outbreaks are caused by a mixture of infections

What turns a normal gut inhabitant into a killer?

1/ POOR HOST IMMUNITY:-
   → Inadequate COLOSTRUM !!
2/ OVERWHELMING CHALLENGE:-
   → Poor HYGIENE and HOUSING !!
3/ TRIGGER FACTORS:-
   → STRESS
   → FEEDING
   → OVERCROWDING

IV/ Consequences of Calf Scours:-

1/ Dehydration
   → FLUID LOSS > FLUID INTAKE
2/ Acidosis
   → Accumulation of ACID in body tissues (pH drop)
3/ Hypoglycaemia
   → LOW BLOOD GLUCOSE
1/ Dehydration:-

Upper eyelid pinch
Glove recession
Oral mucosa
Extremities
Demacon

Mild 4-6%
1-2 sec
None
moist,warm,pink
warm
standing,bright

Moderate 7-9%
3-4 sec
1-2mm
lacky,warm,pale
cold
eternal,slow

Severe >10%
>4 sec
2-4mm
dry,cool,pale
cold
lateral,depressed

2/ Acidosis:-

- Build up of Hydrogen (H+) in tissues.

CAUSED BY:-
- a/ LOSS OF BICARBONATE IN GUT
- b/ PRODUCTION OF ACID IN TISSUES
- c/ PRODUCTION OF ACID IN COLON

→ Depressed CALF

a/ LOSS OF BICARBONATE IN GUT

- NORMAL CALF:-
  - Bicarbonate (HCO₃⁻) scavenges Hydrogen
  - Bicarbonate + Hydrogen → Water + CO₂
    (breathed out)
- ACIDOTIC CALF:-
  - Loss of Bicarbonate → Build up of Hydrogen

BICARBONATE

LIMITED
RE-ABSORPTION

SEVERE
WATERY
SCOUR
b/ PRODUCTION OF ACID IN TISSUES

- **ARTERY**
  - **OXYGEN**
  - **NUTRIENTS**

- **BODY CELLS**
  - **ENERGY**
  - **LACTIC ACID**
  - **ANAEROBIC (OXYGEN-STARVED) RESPIRATION**
  - **REDUCED BLOOD FLOW**
  - **ACIDOSIS**

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c/ PRODUCTION OF ACID IN COLON

- **FERMENTATION (“SOURING”) OF UNDIGESTED MILK IN COLON.**
  - **PRODUCES LACTIC ACID**

- **Abomasum**
  - **Small Intestine**
  - **MALABSORPTION OF FOOD**

- **Colon**
  - **LACTIC ACID**
  - **MILK**
  - **WATER**
  - **FOUL SMELLING SCOUR**
  - **ACIDOSIS**

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3/ Hypoglycaemia

- **A/ IMPAIRED DIGESTION OF MILK**
- **B/ IMPAIRED ABSORPTION OF MILK**

- **VIRUS/PROTOZOA**
- **MALABSORBED FOOD**
- **Small Intestine**
  - **Villus Lining**
  - **DESTROY VILLUS**
  - **WATER**
V/ Treatment
The goal of treatment is to correct:

- Dehydration
- Acidosis
- Hypoglycaemia

Decision Tree

Can the calf Stand?
Can the calf suckle?

Yes
Oral Rehydration Fluids

No
Intravenous Fluids

Oral Fluid Therapy:-

“the most important medical advance of the 20th century”

World Health Organisation, 1985

Reverses fluid balance in a scouring calf from **NET LOSS** to **NET GAIN**.
How to Choose an Oral Fluid...

1. **REHYDRATION ABILITY:-**
   - Depends on SODIUM
   - WHO- 90 mmol/l
   - OPTIMUM- 120-130 mmol/l

2. **ABILITY TO CORRECT ACIDOSIS:-**
   - Depends on source of BICARBONATE
   - Citrate, acetate and propionate do not inhibit abomasal clot formation (Bicarb- Wait 2-3 hours prior to milk feed)
   - AT LEAST 25 – 30 mmol/l
   - OPTIMUM 80 – 120 mmol/l

3. **NUTRITIONAL ABILITY:-**
   - Depends on GLUCOSE
   - GLUTAMINE → May feed gut cells/ promote Na uptake

Benefits of using Bicarbonate Precursors

- Acetate and Propionate used instead of bicarbonate to correct acidosis
- Aid sodium absorption in calf small intestine
- Do not increase abomasal pH therefore do not support *E.coli* and *Salmonella* species
- Inhibit growth of *Salmonella* spp.
- Produce energy when metabolised

Benefits of Amino Acids

- Absorption of Sodium to correct hydration depends on:-
  1. Glucose
  2. Volatile Fatty Acids (Acetate and propionate)
  3. Amino Acids- Glycine, Glutamine
- AA may also be used preferentially as a source of energy by gut cells
Comparison of Common Oral Electrolyte Fluids:

<table>
<thead>
<tr>
<th>NAME</th>
<th>SODIUM</th>
<th>BICARBONATE</th>
<th>GLUCOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>W.H.O.</td>
<td>90 mmol/l</td>
<td>30 mmol/l</td>
<td>111 mmol/l</td>
</tr>
<tr>
<td>LIFEAID XTRA</td>
<td>90 mmol/l</td>
<td>50 mmol/l</td>
<td>175 mmol/l</td>
</tr>
<tr>
<td>LECTADE</td>
<td>50 mmol/l</td>
<td>28 mmol/l</td>
<td>160 mmol/l</td>
</tr>
<tr>
<td>GLUTALYTE</td>
<td>120 mmol/l</td>
<td>80 mmol/l</td>
<td>378 mmol/l</td>
</tr>
</tbody>
</table>

Should we keep feeding milk?

- Milk contains more energy than any oral electrolyte solution
- We recommend continuing to feed milk although calves will initially scour more
- Do not mix milk with oral electrolyte solutions
  - May interfere with abomasal clot formation
- We currently recommend “adding” oral electrolyte as an extra meal while still feeding milk

Intravenous Catheterization (Jugular)
Intraosseous Catheterization

Jamshidi Needle (reusable) driven into the intertrochanteric fossa of the femur

Antimicrobial Therapy

- Decrease the number of *E. coli* in the small intestine
- Treat potential *E. coli* bacteremia (30% of cases)

Evidence-based Principles of Antimicrobial Therapy for Calf Scours

- DIARRHEA accompanied by **SYSTEMIC ILLNESS**
  - Treat with parenteral antimicrobials with a Gram –ve Spectrum.
- Studies Support Parenteral administration of
  - fluoroquinolones (danofloxacin, enrofloxacin, marbofloxacin) (ILLEGAL!);
  - aminocyclitols (Apramycin) and
  - synthetic β-lactams (ampicillin, amoxycillin)
  To treat bacteremia in scouring calves.
**Evidence-based Principles of Antimicrobial Therapy for Calf Scours**

- Studies support the oral administration of amoxicillin, apramycin and fluoroquinolones to treat *E. coli* overgrowth of the small intestine.
- Studies do NOT support the oral administration of potentiated sulfonamides, tetracyclines or neomycin in the treatment of calf scours.
- Calves with DIARRHEA and no systemic illness (normal appetite; no fever) should be monitored and not administered antimicrobials.

**Other Treatment Modalities**

- Nutritional management
- NSAIDs
- Opiates
- Protectants/Adsorbents
- Probiotics
- Biosponge™
- Psyllium mucilloid

**What about Gels (Psyllium)?**

- Thought to enhance nutrient absorption from the digestive tract
  - Slows rate of abomasal emptying
- Recent studies suggest that psyllium may cause less glucose absorption
  - Calves receiving gels have lower energy levels
- We are not recommending the use of electrolyte "gels" at this time
What turns a normal gut inhabitant into a killer?

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1. Enhancing Host Immunity

- Colostrum Feeding
  → 65% reduction in mortality
  1 gallon within first 6 hours
- Pooled Colostrum (colostrumeter) older vaccinated cows
- Cows may reduce antibody secretion in milk up to 2 weeks prepartum
- Pasteurized for Johnes/ Mycoplasma/ EBL
- Continue feeding colostrum
  → Local Immunity?

Beef Cattle
Failure of Passive Transfer

- Occurs in 10-30% of beef calves
  → especially dystocia cases
- Morbidity risk increased 3-9 times
- Mortality risk increased ~5 times
- Transfer must occur within 24 hours of birth
  → Best if within 6-8 hours of birth
- By 9 hours efficiency of absorption decreased by 50%
- Partial Failure Passive Transfer:
  - Lower weaning weights and lower ADG

Perino et al, 1995
Published evidence to support use of rotavirus scour vaccine

- Saif and others (Infect Immun. 1983 Sep; 41(3):1118-31) demonstrated passive immunity to bovine rotavirus in newborn calves fed colostrum supplements from immunized cows. Colostrum was collected and pooled from each of five cows in three experimental groups:
  - **Group I** cows received *intramuscular* (1 week prior to drying off) and *intramammary* (1 week after drying off) inoculations of adjuvanted modified live Ohio Agricultural Research and Development Center rotavirus vaccine;
  - **Group II** cows were injected *intramuscularly* with a commercial modified-live rota-coronavirus vaccine at 6 weeks and 3 weeks precalving; and
  - **Group III** cows were uninoculated controls.

Published evidence for scour vaccine use

- The pooled colostrum from neither group II nor group III cows protected 12 other calves against rotavirus DIARRHEA or shedding when fed at the same rate as Group I.
- Efficacy of rota virus vaccines in clinical settings has not been conclusively demonstrated in the published literature
- We probably just emphasize colostrum management

2. Reducing Pathogen Load
Post-Calving Management

**Pair Management**
- Disperse pairs to a less dense environment as quickly as possible
- Keep sick and high risk calves separate from healthy calves.

**Post-Calving Management**

**Sandhills Calving System**

- **Healthy Nursery**
  - Monitor calves daily for health and morbidity
  - Pull morbid pairs to the sick nursery

*Courtesy of Dr. Mike Sanderson, Kansas State University.*
Post-Calving Management

- Segregation
  - High risk and sick calves
  - Multipliers of infectious agents
  - Build up pathogens to overwhelming levels quickly

Risk group segregation

- *E. coli* → Infected animals main reservoir and source of environmental contamination.
  → Shed $10^{10}$ cfu/gram of feces for several months
- *Rota and Corona viruses* → Mature cow is the reservoir
  → Shed $10^{10}$ virus particles / gram of feces
  → Calves become multipliers when infected

Sandhills Calving System

- Herd 1 Before Implementation:
  - 900 cow, Calf Scours Mortality: 6.5%-14%
  - Avg calving vet cost/yr: $3114.18

- Herd 1 After Implementation:
  - 0 death loss in 3 years
  - Avg calving vet cost/yr: $128.83