Calf Health
Rob Lynch, DVM

- Intro
- Treatment Protocols
- Neonatal Diarrhea
- Calf Pneumonia
- Other
- Immunology & Vaccines

Realizing Genetic Potential – Lifetime Profit

- Suboptimal Colostrum Feeding
- Poor Growth
- Neonatal Diarrhea
- Calf Pneumonia
- Delayed Conception
Are your LACT1 animals performing to their potential?

Cost Per Day
- Birth to Weaning: $6.50
- Weaning to Breeding: $2.00-$2.20
- Breeding to Calving: $2.60-$2.70

Inefficient heifer raising increase costs

Goal Setting
- Stillbirth %: <10%
- Calves dying in 1st 24-48hrs: <2%
- Calves dying 48hrs to Weaning: <5%

Ex: 1000 cow dairy with 30% Herd Turnover %, 50% Female Births

Improving Health, ↓ Replacement Costs

@8% SB, 2% PM, 4% Mortality before weaning
@12% SB, 4% PM, 8% Mortality before weaning

Plan on 122 more freshenings/yr
~$4000 additional expenses up to weaning (excludes tx cost)

Jason Karszes, Cornell University: PRO-DAIRY,
Average Total Heifer Raising Costs 17 NY Dairy Farms, 3rd Quarter 2012
McGuirk, Uof WI-Madison School of Vet Medicine: ASSESSMENT, SCORING AND DISEASE MANAGEMENT OF DAIRY CALVES

Figure 1: Average Heifer Raising Costs Per Day, 2012

Figure 1: Average Milk Production by LCTGP
Goals for Progressive Dairy Calf Programs

- Mortality less than 5%
- Morbidity (treatments) less than 10%
- Double birth weight by 56 days

Benchmarks

<table>
<thead>
<tr>
<th>Target Rates</th>
<th>Mortality</th>
<th>Diarrhea</th>
<th>Pneumonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 hours to 60 days of age</td>
<td>&lt;5%</td>
<td>&lt;25%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>61 to 120 days of age</td>
<td>&lt;2%</td>
<td>&lt;2%</td>
<td>&lt;15%</td>
</tr>
<tr>
<td>121-180 days of age</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
<td>&lt;2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Target Weight Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth to 60 Days</td>
<td>Double Weight</td>
</tr>
<tr>
<td>60 to 120 Days of Age</td>
<td>2.2 Lbs/Day</td>
</tr>
<tr>
<td>121 to 160 Days of Age</td>
<td>2.0 Lbs/Day</td>
</tr>
</tbody>
</table>
Reported Cause of Death

- Unknown reasons
- Other known reasons
- Joint or Naval
- Calving problems
- Injury
- Lameness
- Respiratory
- Diarrhea, or other digestive

Weaned Preweaned

Calf Exam

- **Goal:** collect enough information to consistently and confidently determine:
  - which calves qualify for medical treatment
  - which treatment protocol to apply
  - which calves need additional attention from management and/or vet
Normal Newborn Calf Parameters

- Reduced Calf Vitality
  - Pain, injury, inflammation
  - Hypoxia/acidosis
  - Impaired thermoregulation
  - Fetal blood loss
  - Fractures
  - Trauma

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal Rectal Temperature 102-103°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Resting Heart Rate</td>
<td>100-150 beats/min</td>
</tr>
<tr>
<td>Normal Resting Respiratory Rate</td>
<td>50-75 breaths/min</td>
</tr>
<tr>
<td>Mucous Membranes</td>
<td>pink, moist, CRT &lt; 3sec</td>
</tr>
<tr>
<td>Muscle Tone</td>
<td>sit sternal w/i 5min, attempt to stand w/i 15 min, stand successfully w/i 60 min, ready to nurse w/i 2 hrs</td>
</tr>
</tbody>
</table>

High Risk Calves

- Dystocia or Poor Vitality @ Birth
- FPT
- Previous Disease History
- +/- High Value

1Dr. Sheila McGuirk, UofWI
Calf Exam

- Calf History
  - Treatment Eligible
    - Yes: Exam Findings
      - Normal: Nothing
      - Abnormal: Management / Vet Assessment
    - No: Flag for Cull or Euthanasia, Currently on Treatment
      - Diarrhea Protocol #1
      - Pneumonia Protocol #1
      - Abnormal Exam but Condition Unknown

Treatment Protocols

- Protocol Development
  - Protocol Implementation
  - Protocol Review
Veterinary Client Patient Relationship (VCPR)

- Veterinarian assumes responsibility for making medical judgments regarding the health of the patient with the assent
- Owner of the animal, or their duly authorized agent, agrees to follow the veterinarians guidance
- Veterinarian must:
  - have sufficient knowledge of the patient to initiate at least a general or preliminary diagnosis of the medical condition of the patient
  - be personally acquainted with the keeping and care of the patient by virtue of a timely examination of the patient by the veterinarian, or medically appropriate and timely visits to the operation where the patient is managed
  - be readily available for follow-up evaluation and oversight of treatment and outcomes, or has arranged for appropriate continuing care and treatment
  - maintain patient records

Health Records

Count of 1st PNEU by Month of Event
**Treatment Records**

- Required
- What:
  - Name of drug
  - Animal identity
  - Date of each administration
  - Dosage & Route
  - Length of the withdrawal period & date withdrawal period ends
  - Name of the person who gave the drug
- Retained 2 Years (3 Years NYS)
- Reviewed periodically
  - Completed correctly?
  - Following protocols?
  - Treatments failing?

**No reason given**
**No withhold length or end date**
**No route**
**No name of person who gave the drug**
**Protocol compliance, Tx failure?**
**> Volume per site limitation**

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**Necropsy**

- Identify true cause of death, confirm health exam findings
- Identify preventive measures going forward
Neonatal Diarrhea

Calf Diarrhea Impact

- Higher Mortality Risk
- Treatment Costs
- Higher Risk for BRD
- Risk of Disease Spread
Common GI Pathogens

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Age</th>
<th>Treatment</th>
<th>Hygiene</th>
<th>Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Coli K99</td>
<td>1-7 Days</td>
<td>Supportive, +/- Antibiotic</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>4-28 Days</td>
<td>Supportive</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Coronavirus</td>
<td>4-42 Days</td>
<td>Supportive</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cryptosporidium</td>
<td>7-35 Days</td>
<td>Supportive</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Giardia</td>
<td>14-28 Days</td>
<td>Supportive, Fenbendazole</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td>Any age</td>
<td>Supportive, +/- Antibiotic</td>
<td>✓ +/-</td>
<td></td>
</tr>
<tr>
<td>Coccidia</td>
<td>3-24 Weeks</td>
<td>Supportive</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Clostridium</td>
<td>&lt;8 Weeks</td>
<td>Highly Fatal</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Fecal Consistency Scores

<table>
<thead>
<tr>
<th>Fecal Consistency Score - McGuirk¹</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Semi-formed, pasty</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Loose, but stays on top of bedding</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Watery, sifts through bedding</td>
</tr>
</tbody>
</table>

¹McGuirk, University of Wisconsin – Madison School of Vet Med
Assessing hydration status

- Skin tenting is a quick way to evaluate hydration.
- Pinch a fold of skin on the neck and count the number of seconds it takes to flatten.
- If the skin flattens < 2 seconds, this indicates normal hydration.
- If the skin takes 2-6 seconds to flatten, the calf is about 8% dehydrated.
- Over 6 seconds would indicate severe dehydration over 10%.
- Gum color and moisture can also be evaluated. Normal gums will be pink and damp while white and dry gums indicate dehydration.

### Guidelines for assessment of hydration status in calves with diarrhea

<table>
<thead>
<tr>
<th>Dehydration</th>
<th>Demeanor</th>
<th>Eyeball Recession</th>
<th>Skin Tent Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5%</td>
<td>Normal</td>
<td>None</td>
<td>&lt; 1 sec</td>
</tr>
<tr>
<td>6% - 8% (mild)</td>
<td>Slight depressed</td>
<td>2-4 mm</td>
<td>1 - 2 sec</td>
</tr>
<tr>
<td>8% - 10% (moderate)</td>
<td>Depressed</td>
<td>4-6 mm</td>
<td>2 - 5 sec</td>
</tr>
<tr>
<td>10% - 12% (severe)</td>
<td>Comatose</td>
<td>6-8 mm</td>
<td>5 - 10 sec</td>
</tr>
<tr>
<td>&gt; 12%</td>
<td>Comatose/dead</td>
<td>8-12 mm</td>
<td>&gt;10 sec</td>
</tr>
</tbody>
</table>

1Jennifer Bentley, Dairy Specialist, Iowa State University Extension and Outreach
Aims of oral rehydration therapy (ORT)

- Replace lost sodium and thus normalize the extracellular fluid volume (interstitial and intravascular volume spaces)
- Facilitate the uptake of sodium and water from the gastrointestinal tract (e.g., by providing glucose)
- Provide an alkalinizing agent or buffer to help correct the likely metabolic acidosis
- Provide an energy source for the calf (although this is rarely achieved with ORT alone).

When not to use Oral Rehydration Therapy

- Moderate to severe hypovolaemia (8-10% dehydration)
  - Decreased blood flow to GI tract
  - Decreased GI and absorption of fluids/electrolytes/nutrients
- Unable to stand (aspiration pneumonia risk)
- Lacking suck reflex
- Calves with obstructive gastrointestinal disease (“bloated”)
Oral Rehydration Therapy

- It is nearly impossible to feed the calf too much electrolytes, but feeding too little is quite common
- Determine the amount of electrolytes to feed:

\[
\text{Quarts of Liquid Needed Per Day} = \frac{\text{Calf Weight} \times \% \text{ Dehydrated}}{2}
\]

- Ex. 100-lb calf is dehydrated 8% (100 x 0.08), 8 lbs of liquid divided by 2 equals 4 quarts needed per day in addition to normal feeding of milk
- When > 90ºF increase amount by 50%. (>100ºF double the amount)

Oral Rehydration Therapy

- Electrolytes should be fed several hours after feeding whole milk or milk replacers containing significant amounts of skim milk or casein.\(^1\)
  - ingredients in electrolytes may impair the formation of the casein clot in the abomasum
  - can be fed along with milk (particularly those products that contain acetate or very low concentrations of bicarbonate)

Example ORT Schedule:

<table>
<thead>
<tr>
<th>Time</th>
<th>Milk / Milk Replacer</th>
<th>Electrolytes</th>
<th>Milk / Milk Replacer</th>
<th>Electrolytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 am</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 noon</td>
<td></td>
<td>Electrolytes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 pm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 pm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)Quigley, 2001
Diarrhea incidence reaches alarm level

- **Identify cause**
  - Adjust treatment protocol if necessary
  - Adjust preventive measures if indicated
- **Break cycle of disease**
  - Clean up
  - SOME PATHOGENS ZOONOTIC
  - Reduce additional exposure

Calf Pneumonia
Calf BRD Impact

- Higher Mortality Risk
- Slower Growth / Delayed Entry to Milking Herd
- Treatment Costs
- Lower Future Milk Production
- Risk of Disease Spread

Case Example: Calf Pneumonia

- 2016
  - Pneumonia Incidence ~70%
  - 5% Died
  - 53% of Remaining Calves Removed by 2019
- 2019
  - ~100 1st Lact Cows Remained
  - 305ME Comparison for DIM>90
  - No Calf Pneumonia vs. Calf Pneumonia

305ME Comparison for DIM>90:
- No Calf Pneumonia: 32137 Lb
- Calf Pneumonia: 31243 Lb
  - 894 Lb Diff
Respiratory System

Upper Airway:
- conduction, mucociliary apparatus, non-sterile

Lower Airway:
- gas exchange, air/blood barrier, sterile

Mucociliary Apparatus (Escalator)

- Ciliated Epithelium
- Goblet Cells – Mucus
- Mechanical sweeping of debris, bacteria, and viruses
Viral BRD

Bovine Respiratory Syncytial Virus
Bovine Herpesvirus-1 (IBR)
Bovine Viral Diarrhea Virus (BVDV)
Bovine Parainfluenza Virus-3

![Photo 1: Trachea Post BRSV Challenge](Photo 1)

![Photo 2: Healthy Lung](Photo 2)

![Photo 3: Diseased Lung Post BRSV Challenge](Photo 3)

1Photo Credits: John Ellis, John A. Ellis, DVM, PhD, University of Saskatchewan, Pfizer Animal Health

BVDV

![Diagram of BVDV infection cycle]

- Normal Healthy Calf
- Abortion / Stillbirth
- Weak or Deformed Calf
- Persistent Infection
- Virus Shedding
Bacterial Pneumonia

Mannheimia haemolytica
Pasteurella multocida
Histophilus somni
Mycoplasma bovis
Salmonella sp

Photo: Mycoplasma bovis

Calf Respiratory Disease Scoring
Dr. Sheila McGuirk
• Uncovered High Frequency of Subclinical Pneumonia
• Lower Body Weights in Affected Calves

BRD incidence reaches alarm level

• Identify cause
  • Adjust treatment protocol if necessary
  • Adjust preventive measures if indicated

• Break cycle of disease
  • Clean up
  • SOME PATHOGENS ZOONOTIC
  • Reduce additional exposure
Joint ill (navel illness)

• Infection enter umbilical cord at or soon after birth
• Navel ill—swollen, painful navel, abscess may develop (thick custard), may burst
• Joint ill—spread from navel via bloodstream to other parts of body, most commonly joints
• Prevention: Pen hygiene, naval dipping procedures, colostrum management

Dystocia Consequences

• Severe Dystocia Calves:¹
  • 1.7x > Risk of BRD
  • 1.3x > Risk of Digestive Disease
  • 6.7x > Risk of Mortality

¹ Lombard et al., 2007
Immunology & Vaccines
Biosecurity  Bio containment

Friends don’t let friends be fomites
Anamnestic Response

<table>
<thead>
<tr>
<th>Time</th>
<th>Immune Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1°</td>
<td></td>
</tr>
<tr>
<td>2°</td>
<td></td>
</tr>
</tbody>
</table>

* Memory

Passive vs. Active Immunity

**Passive**
- Immediate
- Short Lived
- No Memory
- Some Reactive
- Ex: antibodies, antitoxins

**Active**
- Delayed
- Long Lived
- Memory
- MLV Vaccines, Bacterins, Toxoids
**MLV Vaccine**

**Pros**
- Robust immune response
- No booster
- Lower risk of reaction
- Lower cost/dose

**Cons**
- Must handle carefully

**Killed Virus Vaccine**

**Pros**
- Higher cost/dose
- Must booster
- Narrower immune response
- Higher risk of reactions

**Cons**
- Convenient
- Safe in all animals
- No unused doses

* Some are safe to use in pregnant cows as long as label directions are followed.

‡ “Use entire contents when first opened.”

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**Vaccination Protocols**

- **Risk Assessment**
  - Exposure possibilities
  - Facilities
  - Labor

- **Vaccine Selection**
  - Efficacy
  - Safety
  - Timing/Interval
**Vaccine Insert**

- Species, Production Class, Age, Pregnancy Status
- Dose, Route, Frequency (booster?)
- Warnings
- Storage, Expire Date
- USDA Withhold statement

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**Scours Vaccines**

- Serum antibodies begin to move into the mammary gland 5-6 weeks prior to calving

3 Weeks Prior - Primary Vaccination for Springers
Dry Cow Booster
Age at vaccination

Window of Susceptibility

Endogenous Specific VN Antibodies

Protective titre against disease

Permissive titre for immunization

Specific Maternal Antibodies

Figure: Chase, et al, Vet Clin North Am Food Anim Pract. 2008

Common Findings

• Protocol Drift
  • New challenges
  • New products
  • New people

• Disorganization

• Improper Storage
  • 35–45°F
  • Door
  • Colostrum
  • Outdoors/Freezing
Common Findings

• No booster
• Mishandled MLV Vaccine
• Vaccination >85°F
• Endotoxin Overload
  • Limit Gm^- to 2

Gm^- Vaccines

<table>
<thead>
<tr>
<th>Leptospirosis</th>
<th>E. Coli Scours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mannheimia</td>
<td>Salmonella</td>
</tr>
<tr>
<td>Coliform Mastitis</td>
<td>Clostridium</td>
</tr>
<tr>
<td>Histophilus</td>
<td>Pinkeye</td>
</tr>
</tbody>
</table>

Thank You

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