Improving Health and Survival of Newborn Dairy Calves

Franklyn Garry

Heifer raising
- Number of animals
- Second largest dairy expense
- Profitability determinants
  - Rate of gain
  - Age at calving
  - Weight at calving

Food for Thought
- Despite the importance of calf health, and the high incidence of calf disease and death, this area receives limited attention from producers and veterinarians

Causes of Deaths in Pre-weaned Calf

Mortality Rates
- 8.4% - (NAHMS, 1993)
- 8.7% - (NAHMS, 2002)
- 10.8% - (NAHMS, 1996)
- 7.8% - (NAHMS, 2007)

 causes of deaths:
- Scours: 56%
- Respiratory: 23%
- Joint Ill: 2%
- Other: 19%
**Neonatal Calf Losses**

- Death < 2 days old
  - Typically non-infectious
  - Associated with physiological derangements
    - Birthing trauma, difficult postnatal adaptation, etc.
- Death ≥ 3 days old
  - Likely infectious in nature
  - Potential physiologic problems that don’t kill may predispose to infectious problems

**Adaptation to extrauterine life**

- Tremendous physiologic transition
- Numerous influences
- Not always successful

**Neonatal adaptation**

**Organ system changes**

- Respiratory
- Cardiovascular
- Metabolic
- Fluid balance
- Thermoregulation
- Musculo-skeletal
- Neurologic

**Blood oxygenation**

**Oxygen delivery**

- Pulmonary (Lung) blood flow
- Ventilation
  - Lung expansion
  - Lung fluid
- Physical/muscular activity
- Blood volume – oxygen delivery
Fluid volume and balance

- ‘Swimming pool’ environment
- Normal tissue hydration
- Blood volume contraction
- Need fluid supplementation to maintain circulatory volume

Thermogenesis = Body heat generation

- Non-shivering
- Shivering
- Physical activity

Blood gas and Acid/Base in Newborn Calves

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Mean (SD) values of arterial and venous blood gas and acid base analyses in 57 newborn calves from birth to 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Time of sampling</td>
</tr>
<tr>
<td></td>
<td>Arterial</td>
</tr>
<tr>
<td>pH</td>
<td>7.38 (0.03)</td>
</tr>
<tr>
<td>PaO2 (mm Hg)</td>
<td>53.7 (16.60)</td>
</tr>
<tr>
<td>PaCO2 (mm Hg)</td>
<td>28.9 (5.36)</td>
</tr>
<tr>
<td>HCO3 (mmol/L)</td>
<td>26.7 (3.50)</td>
</tr>
<tr>
<td>Base excess (mmol/L)</td>
<td>0.86 (11.02)</td>
</tr>
<tr>
<td>SO2 (%)</td>
<td>64.16 (26.02)</td>
</tr>
</tbody>
</table>

- Arterial: arterial blood gas and acid base analysis in newborn calves from birth to 24 hours.
- 3A Min: 3A week (at birth).
- 24 Hours: 24 hours (at birth).
- 48 Hours: 48 hours (at birth).
- 72 Hours: 72 hours (at birth).
- 96 Hours: 96 hours (at birth).

- Assumptions: HCO3, base excess, PaO2, partial pressure of carbon dioxide; PaCO2, partial pressure of oxygen; SO2, oxygen saturation.
- Analysis of variance for repeated measures within groups.

Failure to adapt adequately may not be obvious

- Adaptive processes interrelated
- Disturbances usually multiple
- Onset of problems may be delayed
- Problems usually subtle, nonspecific
Consequences of poor adaptation
- Decreased activity, lethargy
- Low blood oxygen
- Heat loss, low body temperature
- Delayed intake of colostrum
  - Decreased energy/nutrient intake
  - Decreased fluid volume
  - Decreased Ig consumption
- Decreased disease resistance

Abnormal Neonatal Adaptation
- Dystocia
- Premature birth
- Illness in dam
- In-utero problems

Dystocia
- Defined as delayed or difficult parturition
  - Fetal-maternal size mismatch
  - Fetal malpresentation
  - Maternal causes
- Dystocia increases the degree of neonatal asphyxia and makes it harder for calves to adapt successfully

Food for Thought
- Dystocia is NOT perceived to be a major problem on Dairies, although it occurs at remarkably high rates.
- Non-infectious disease conditions of dairy calves, associated with dystocia, account for 1/3 to 1/2 of calf losses, but these losses are almost ignored.
Heifer and Cow Calving Difficulty

<table>
<thead>
<tr>
<th>Calving Difficulty</th>
<th>Percent Heifers</th>
<th>Std. Error</th>
<th>Percent Cows</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe dystocia (surgical or mechanical extraction)</td>
<td>6.8</td>
<td>0.7</td>
<td>3.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Mild dystocia</td>
<td>11.8</td>
<td>0.8</td>
<td>7.3</td>
<td>0.5</td>
</tr>
<tr>
<td>No dystocia, but assistance provided anyway</td>
<td>12.4</td>
<td>1.0</td>
<td>9.8</td>
<td>0.9</td>
</tr>
<tr>
<td>No assistance</td>
<td>69.0</td>
<td>1.4</td>
<td>79.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td></td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

1 As a percentage of dairy cow replacements entering the milking herd in 2007.
2 As a percentage of cows on the operation at the time of the initial visit interview.

Dystocia Prevalence Estimates
- Heifers 28.6% → 48.8%
- Cows 10.7% → 29.4%
- Overall 20-40%
- Dystocia is under-estimated and very common problem on dairy operations and has lasting effects

Stillbirths
- Calf delivered dead or dies within 48 hrs
- Often not monitored/tracked on dairies
- Some genetic effects
- Some infectious issues — Coxiella, Neospora, Campylobacter, Leptospira
- Dystocia has major effect
  - Primiparous = 12.6% Multiparous = 6.1% Overall 8.2%
- Compare with 7.8% to 11% reported preweaning heifer deaths — infectious dz


Perinatal Dairy Calf Death Losses
- Calf death before, during, or within 48 hours of calving = Stillborn
- Estimated between 7-8%
- Stillborns: 78.6% born dead; 21% born alive
- ~90% of stillborns alive at start of calving

(Lombard – JDS 2007)
Dystocia Severity Scoring

Score 1 = No assistance

Score 2 = One person pull

Score 3 = Severe traction or surgery

Effects on Heifer Calves – Deaths

Effects on Heifer Calves – Disease

Take Home Messages

- The most dramatic physiological changes occur during birth and death.
- Dystocia has an immediate and prolonged effect on the health and productivity of calves.
- Perinatal mortality due to dystocia accounts for about half of all calf deaths through weaning and increases risk of infectious disease.
Food for Thought

- Simple management and husbandry practices can significantly reduce losses associated with dystocia

“If you always do what you always did, you’ll always get what you always got.”

Management to decrease dystocia losses

- Decrease occurrence of dystocia
- Manage dystocia to decrease impact on calves and dams
- Identify abnormal calves and provide more care

Minimizing Dystocia Impacts

- Calving
  - Stress free and comfortable, clean area
  - Monitor cow’s progress
  - Assist appropriately when necessary
- Newborn Calf Care
  - Monitor all newborns
  - Provide assistance
  - Assume all dystocia calves need help
**Calving management**

- Frequent observation
- Note time
- 1\(^{st}\) stage – 4 hrs
- 2\(^{nd}\) stage –
  - Cow – 1 hr
  - Heifer – 2 hr
Minimizing Dystocia Impacts

- **Calving**
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- **Newborn Calf Care**
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Normal newborn calves

- Uncomplicated vaginal delivery
- Time to stand < 1 hour
- Good mothering
- Body temperature maintenance
  - 101-102°F
- Active suckling < 2 hours
- Attentive, responsive, active
Neonatal Assistance

- Stimulate and enhance respiration
  - Assist in ventilation of the lungs (breathing)
  - Stimulate by rubbing / drying calf
- Maintain body temperature (thermoregulation)
  - Provide supplemental heat
- Increase blood volume and provide energy
  - Administer colostrum

Neonatal Assistance

- Stimulate and enhance respiration
- Place in sternal recumbency
- Remove mucus from airway
- Vigorous drying/rubbing on chest
- Provide positive pressure ventilation
- Administration of oxygen

Assessment of Vigor

- Head-right, sternal recumbence, attempt to stand, standing
- 3, 5, 20, 60 minutes, respectively
- ↑ 15 min to sternal = 84% predictive of nonvitality

Schuijt G., Taverne MA. Vet Record. 1994; 135.
Oxygen Administration

**O₂ flow rate**= 2-4L/min

− Maintain body temperature (thermoregulation)
  − Calves generate heat (thermogenesis) via:
    − Physical activity – most important source of heat
    − Shivering – involuntary muscle contractions
    − Nonshivering (1° Brown fat)
  − Calves lose heat via:
    − Evaporation – reduce by drying calves (also stimulates respiration)
    − Conduction – reduce by providing straw or other bedding
    − Convection – reduce exposure to wind; dry calves

Neonatal Assistance
Neonatal Assistance

- Maintain body temperature
- Supplemental heat sources
  - Heaters, hot water bottles; warming hut
  - Colostrum – also provides energy for activity
  - Calf jacket
- If calf’s temp is 100° or less – provide heat source

Food for Thought: Thermogenesis

- Infrared heater for 24 hrs postpartum
- Significant improvements to:
  - Rectal temp, \( \text{So}_2(\%) \), tidal volume, dynamic lung compliance, & respiratory rate

Neonatal Assistance

- Increase blood volume and provide energy

Non-immunoglobulin Components of Colostrum

- Other immune-active agents
- Optimum source of standard nutritional elements
- Concentrated energy, protein, vitamins, minerals
- Fluid, warmth

Neonatal Assistance

- Stimulate and enhance respiration
  - Sternal recumbency
  - Mechanical ventilation
  - Oxygen therapy
- Maintain body temperature
  - Heaters
  - Blankets
- Increase blood volume and provide energy
  - Colostrum

Calving/Dystocia Monitoring Program

- Record the following:
  - Date of birth
  - Dam / lactation # / Sire
  - Calf alive / dead
  - Singleton, twin, triplet
  - Gender
  - Dystocia score (1,2,3)
  - Calf vigor – time to stand and nurse
  - Colostrum quality / timing / volume
Take Home Messages

- Dystocia monitoring should be implemented on every dairy farm.

- Simple interventions for the first few hours after birth can make the difference between life and death.

- Dystocia and subsequent morbidity/ mortality are major economic AND animal-welfare issues for the dairy industry.