Improving Health and Survival of Newborn Dairy Calves

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Heifer raising

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

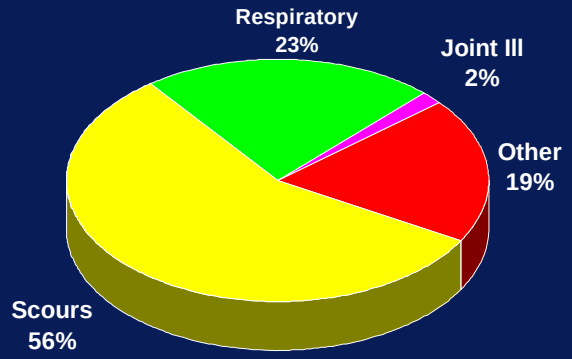
Food for Thought

- 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); 10.8% - (NAHMS, 1996)
8.7% - (NAHMS, 2002); 7.8% - (NAHMS, 2007)



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

Blood gas and Acid/Base in Newborn Calves

Table 1
Mean (SD) values of arterial and venous blood gas and acid-base analyses in 57 newborn calves from birth to 24 hours

		Time of Sampling						
Variable	Blood	At Birth	30 Minutes	4 hours	12 Hours	24 Hours	P^a	P^b
pH	Arterial	7.30 (0.06)	7.36 (0.04)	7.38 (0.03)	7.42 (0.03)	7.43 (0.04)	<0.001	>0.05
	Venous	7.24 (0.09)	7.30 (0.04)	7.33 (0.03)	7.38 (0.04)	7.40 (0.06)	<0.001	
Pco_2 (mm Hg)	Arterial	57.31 (4.98)	52.58 (5.00)	48.70 (3.73)	43.71 (4.75)	44.22 (4.32)	<0.001	<0.001
	Venous	67.34 (10.39)	58.23 (10.43)	54.36 (6.10)	47.03 (5.75)	46.67 (6.24)	<0.001	
Po_2 (mm Hg)	Arterial	45.31 (16.02)	58.08 (13.12)	67.66 (14.55)	71.89 (8.32)	66.77 (14.21)	<0.001	<0.05
	Venous	20.94 (5.30)	27.95 (5.42)	29.15 (4.41)	29.33 (5.52)	27.62 (3.04)	<0.001	
Hco^-_3 (mmol/l)	Arterial	26.76 (3.39)	28.01 (2.44)	27.40 (2.32)	26.96 (2.94)	28.31 (3.26)	>0.05	>0.05
	Venous	27.24 (3.70)	27.48 (3.81)	27.42 (3.18)	26.42 (2.82)	27.87 (3.35)	>0.05	
Base excess (mmol/L)	Arterial	0.86 (4.12)	2.9 (2.88)	2.52 (2.64)	2.78 (3.23)	4.42 (3.59)	>0.05	>0.05
	Venous	1.01 (3.49)	1.53 (4.37)	1.89 (3.48)	1.59 (3.08)	3.40 (3.92)	>0.05	
So_2 (%)	Arterial	64.16 (20.82)	82.08 (9.98)	89.23 (6.84)	92.84 (2.32)	89.75 (8.31)	<0.001	>0.05
	Venous	22.64 (10.00)	39.26 (10.98)	44.19 (9.39)	47.41 (12.06)	47.81 (15.41)	<0.001	

Abbreviations: Hco^-_3, bicarbonate; Pco_2, partial pressure of carbon dioxide; Po_2, partial pressure of oxygen; So_2, oxygen saturation.
[a] Analysis of variance for repeated measures within groups.
[b] Analysis of variance for repeated measures between groups.
Data from Bleul U, Lejeune B, *Schwantag* S, et al. Blood gas and acid-base analysis of arterial blood in 57 newborn calves. Vet Record 2007;161:688–91.

Poulsen KP., McGuirk SM. Vet Clin Food Anim 25 (2009)

Thermogenesis = Body heat generation

- Non-shivering
- Shivering
- Physical activity

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

Calving Difficulty	Percent Heifers[1]	Std. Error	Percent Cows[2]	Std. Error
Severe dystocia (surgical or mechanical extraction)	6.8	(0.7)	3.5	(0.3)
Mild dystocia	11.8	(0.8)	7.3	(0.5)
No dystocia, but assistance provided anyway	12.4	(1.0)	9.8	(0.9)
No assistance	69.0	(1.4)	79.4	(1.3)
Total	100.0		100.0	

[1]As a percentage of dairy cow replacements entering the milking herd in 2006.
[2]As a percentage of cows on the operation at the time of VS Initial Visit interview.

2009. USDA:APHIS:VS:CEAH. Dairy 2007, Calf Health and Management Practices on U.S. Dairy Operations

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 w/in 48hrs
- 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

(Lombard –JDS 2007)

Perinatal Dairy Calf Death Losses

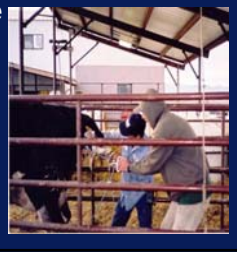
- Calf death before, during, or within 48 hours of calving = Stillborn
- Estimated between 7-8%
  - Meyer et al., 2000; Silva del Rio et al., 2007; USDA:APHIS:VS:CEAH. Dairy 2007
- Stillborns: 78.6% born dead; 21% born alive
  - 2009. USDA:APHIS:VS:CEAH. Dairy 2007, Calf Health and Management Practices on U.S. Dairy Operations
- ~90% of stillborns alive at start of calving
  - Mee JF. Vet Clin Food Anim. 24 (2008).

Dystocia Severity Scoring

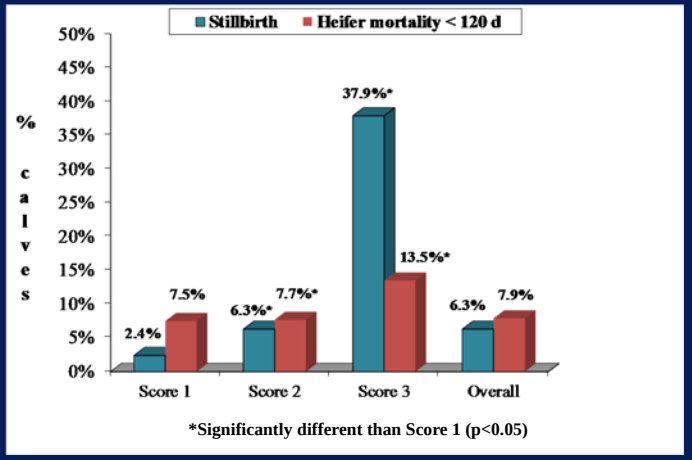
Score 1 = No assistance

Score 2 = One person pull

Score 3 = Severe traction or surgery



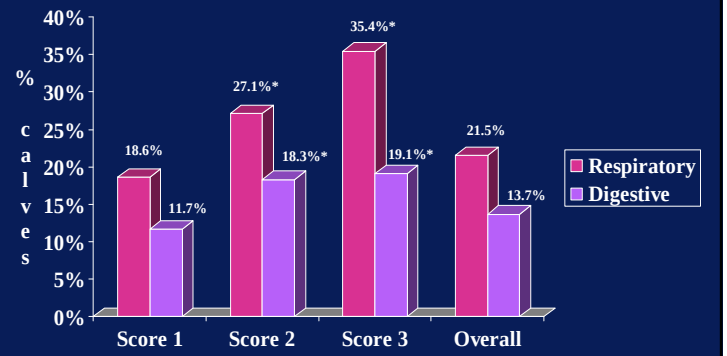
Effects on Heifer Calves – Deaths



*Significantly different than Score 1 ($p<0.05$)

Lombard, et al. JDS 2007

Effects on Heifer Calves – Disease



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Lombard, et al. JDS 2007

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

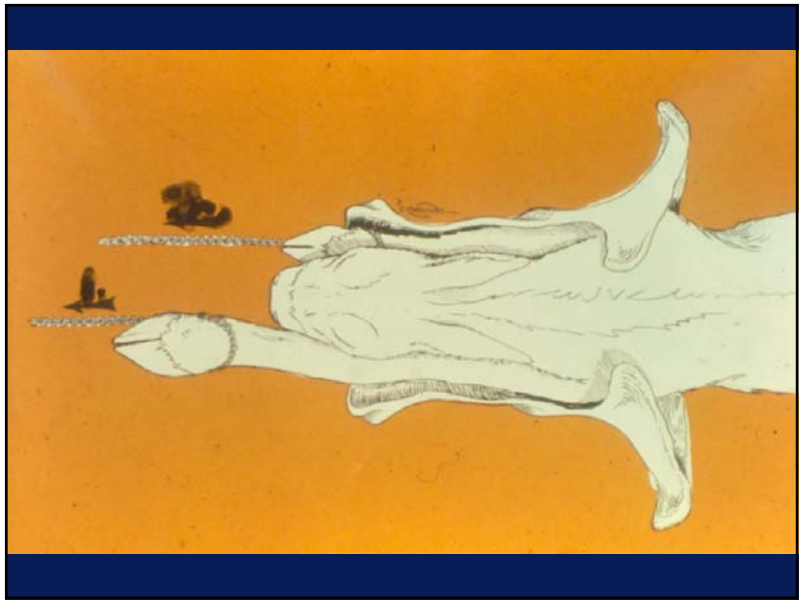
Minimizing Dystocia Impacts

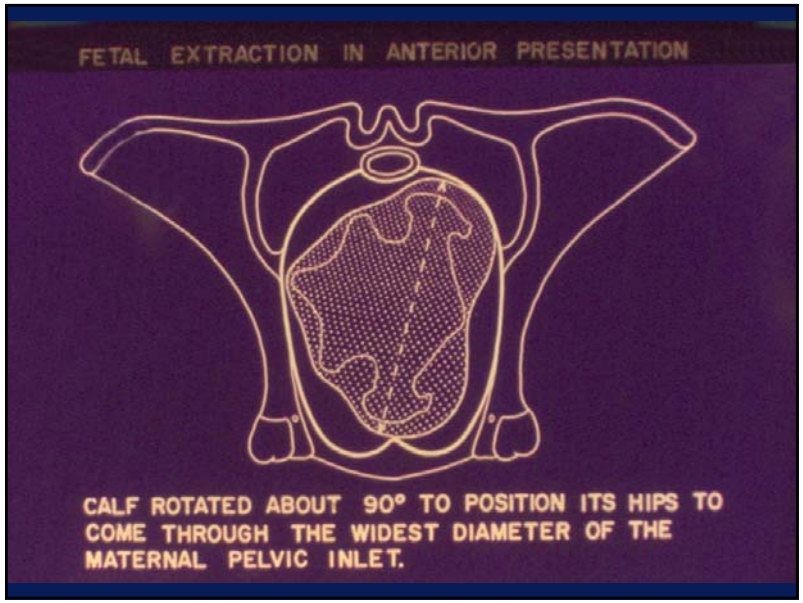
- Calving
  - Stress free and comfortable, clean area
  - Monitor cow's progress
  - Assist appropriately when necessary
- Newborn Calf Care
  - Monitor all newborns
  - Provide assistance
  - Assume all dystocia calves need help

Calving management

- Frequent observation
- Note time
- 1st stage – 4 hrs
- 2nd stage –
  - Cow – 1 hr
  - Heifer- 2hr


1.
2.




FETAL EXTRACTION IN ANTERIOR PRESENTATION
CALF ROTATED ABOUT 90° TO POSITION ITS HIPS TO COME THROUGH THE WIDEST DIAMETER OF THE MATERNAL PELVIC INLET.

http://www.cvmbs.colostate.edu/ilm/

Integrated Livestock Management

Minimizing Dystocia Impacts

- Calving
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  - Monitor cow's progress
  - Assist appropriately when necessary
- Newborn Calf Care
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Normal newborn calves

- Uncomplicated vaginal delivery
- Time to stand < 1 hour
- Good mothering
- Body temperature maintenance
  - 101-102F
- 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

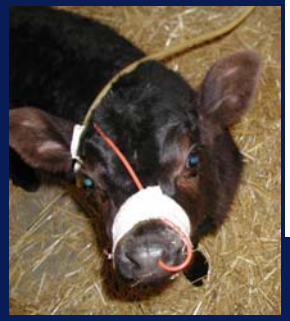
- Stimulate and enhance respiration
  - Place in sternal recumbency
  - Remove mucus from airway
  - Vigorous drying/rubbing on chest
  - Provide positive pressure ventilation
  - Administration of oxygen

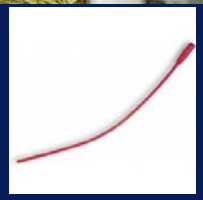
Assessment of Vigor

- 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





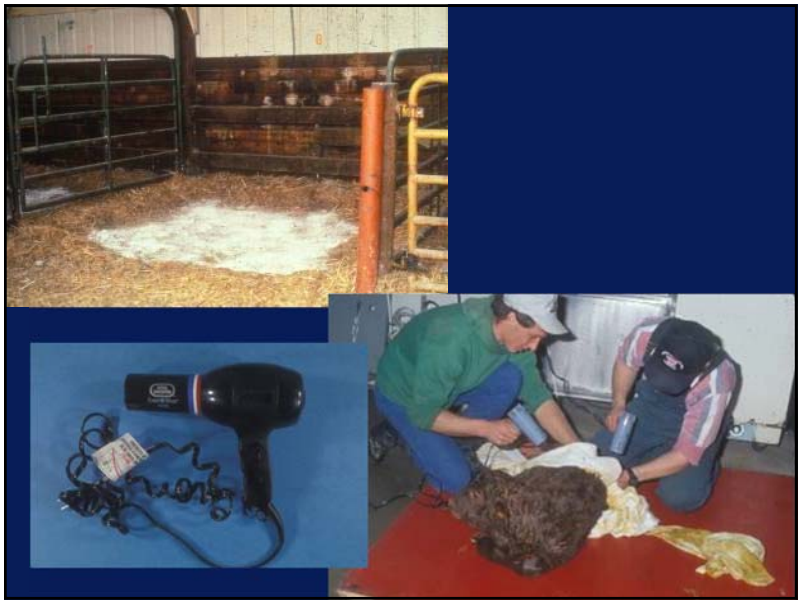
O_2 flow rate= 2-4L/min

Neonatal Assistance

- 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

- 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, So_2(%), tidal volume, dynamic lung compliance, & respiratory rate

Uystepruyst CH, et al. Vet J (2002) 52.

Neonatal Assistance

- ✓ Increase blood volume and provide energy

Non-immunoglobulin Components of Colostrum

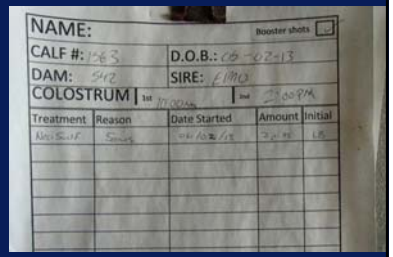
- Other immune-active agents
- Optimum source of standard nutritional elements
- Concentrated energy, protein, vitamins, minerals
- Fluid, warmth

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.