Proper Dry-Off Procedures to Prevent New Infections and Cure Existing Cases of Mastitis

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Dry Cow Therapy

- Prevent new infections by environmental organisms
- Eliminate infections present at dry off
Keys to Prevention of New Infections

- Environmental Management-Clean, dry, cool, comfortable
- Dry cow therapy
- Teat Sealants
- Nutrition
- Vaccination-Enviracor J-5, J-Vac, Endovac Dairy
Mastitis Definition:

Mastitis (intramammary infection) occurs when bacteria enter the teat orifice, multiply within the mammary gland, and elicit an inflammatory response (↑SCC).

Result:

- Decreased milk quality & yield
- Adversely affects animal health
An understanding of:

✓ Physiology of the dry period
✓ Anatomy of teat end tissues

Clinical/Subclinical Mastitis

Instrumental in maximizing benefits of properly drying off mammary quarters to cure IMI and prevent new infections
Physiology of the Dry Period

- Function of the mammary gland during lactation: continuous synthesis/secretion of large quantities of milk; then dried off.

- The mammary gland progresses through three distinct stages:
  - 1) Active involution
  - 2) Steady state involution
  - 3) Colostrum formation
    - “Colostrogenesis”

After dry-off

Dry Period:
Needed to optimize milk production in next lactation

(↑ Susceptibility to mastitis)
RELATIVE FREQUENCY OF NEW INFECTIONS DURING LACTATION AND THE DRY PERIOD

Active Steady state

CALVING

DRYING OFF

CALVING

6-fold higher (2-3 wk)

Majority: Environmentals:

- *Escherichia coli*
- *Streptococcus uberis*  

(In addition to existing IMI)

>50% of all CM in early lactation: “Environmentals” acquired during the dry period

---Lactation---

Why the increased susceptibility at the beginning and end of the dry period?
1. Active Involution
(Termination of milking → 3-4 wk into dry period)

- Maximum accumulation of fluid occurs within ~2 to 3 days of drying off.
- Milk volume decreases significantly by ~4 days of involution.
- Fluid volume continues to decrease through at least day 16 of the dry period, and probably through day 30.

Result of: Resorption, some leakage
Elevated rate of new infections during active involution due to:

- Flushing of colonized bacteria terminated
  - No more 2-3 times a day milking

- Udder sanit. & teat dipping discontinued
  - Bacteria accumulate on the skin

- Dilation and shortening of teat duct
  - Milk pressure, leakage, ↓ keratin

- Leukocytes more active in removing milk components than microorganisms

Casein & fat: Inefficient
2. Steady State Involution

(1-2 wk)

↓ Susceptibility to new infections due to:

• 1. High levels of antibacterial factors: Antibodies & Lactoferrin (sequesters Fe)

• 2. Reduced rate of bacterial penetration through the teat canal
  – Lower level of teat end exposure to potential mastitis pathogens
    • The development of a **keratin plug**

  (Functions as a physical & chemical barrier: antimicrobial proteins & fats)
3. Colostrogenesis (1-3 wk prepertum)

- Susceptibility to new infection is increased just prior to calving:
  - Increased fluid volume → dilation of the teat canal (leaking) allowing bacterial entry
  - Reduced leukocyte numbers and loss of their ability to engulf microorganisms.
  - Utilization of milk components by mastitis microorganisms → growth & multiplication.
  - Absence of residual antimicrobial activity of dry cow therapy.
    - Lack of antibiotic residues from treatment of all four quarters at the time of drying off
Teat canal (duct) is the 1st line of defense, providing:
(A) Keratin and (B) Sphincter muscle as physical/chemical barriers
When treatments are applied to the teat end, the natural tissue architecture (keratin, sphincter) should be protected as much as possible to maximize treatment efficacy, e.g., Antibiotic or Teat seal.
Proper infusion procedures:
(Antibiotic or Teat sealant)

Using gloves

Kills contaminating bacteria

**Sanitize teat orifice, use partial insertion technique, dip teats**
Management factors to consider at dry-off to minimize stress and environmental exposure

• Reduce feed over last 2 wk to reduce yield
  – Feed high fiber diet; eliminate grain; switch from alfalfa to grass, or straw for very high producers.
  – Reducing water intake is questionable as it is the most crucial nutrient and promotes animal health.

• Dry-off at a BCS of ~3.5
Method of Drying Off

**Abrupt cessation** vs. **Intermittent milking**

- Milk for 305-day lactation
- **STOP** Milking
- Infuse with DCT +/- or TS
- Place in far-off pasture/lot

**Intermittent milking**

- Milk for ~291-298 days
  - 1-2 wk prior to dry-off date
- For last 1-2 wk of lactation:
  - Eliminate conc. (hay only)
  - Limit water intake????
  - Milk intermittently, e.g., 1X
- Infuse/place in far-off lot

  ↓ production 22-47%

↓ New IMI at calving

Accelerates involution
Cows with greater milk yield at dry-off → leak milk → incomplete keratin plug formation at teat end

Increases chances for bacterial entry through the teat canal

Within several days-weeks, teat canal closes up, with the formation of a keratin plug

Decreases bacterial penetration: Physical barrier, antimicrobials
Mammary quarter infection status at dry-off:

1. Existing intramammary infections that should be treated & eliminated
2. Uninfected quarters that *should* be treated to prevent new infections
   a) Antibiotic?
   b) Teat seal?
   c) Teat seal + antibiotic?
   d) No treatment?
Treat all 4 quarters of all cows at drying off "Blanket DCT" (1950s)
Prevalence, cure rates, and new IMI of quarters treated at drying off with various penicillin & cephalosporin products

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Qtr infection Rate</th>
<th>Qtr Cure Rate</th>
<th>New Qtr IMI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>S. aureus</td>
<td>18 (2.78%)</td>
<td>17 (94.4%)</td>
<td>14 (2.16%)</td>
</tr>
<tr>
<td>S. agalactiae</td>
<td>23 (3.55%)</td>
<td>23 (100.0%)</td>
<td>11 (1.70%)</td>
</tr>
<tr>
<td>S. dysgalactiae</td>
<td>10 (1.54%)</td>
<td>10 (100.0%)</td>
<td>3 (0.46%)</td>
</tr>
<tr>
<td>S. uberis</td>
<td>0</td>
<td>0</td>
<td>1 (0.16%)</td>
</tr>
<tr>
<td>CNS</td>
<td>137 (21.14%)</td>
<td>107 (78.1%)</td>
<td>80 (12.34%)</td>
</tr>
<tr>
<td>E. faecalis</td>
<td>2 (0.31%)</td>
<td>2 (100.0%)</td>
<td>2 (0.31%)</td>
</tr>
<tr>
<td>E. coli</td>
<td>1 (0.15%)</td>
<td>1 (100.0%)</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>2 (0.31%)</td>
<td>2 (100.0%)</td>
<td>2 (0.31%)</td>
</tr>
</tbody>
</table>

DCT: Cures IMI at drying off & prevents new IMI

Avg: 70-90%  
40%↓ (Avg: 50-80%)

Petzer et al., 2009
Multiple antibiotic infusions? Improve cure rates?

- Treating twice at drying off, or
- At dry off & at some later time(s)
- Not demonstrated to be beneficial
- Subsequent treatments after dry-off may pose additional risks:
  - Introducing bacteria into the gland via the syringe cannula
  - Increasing risk of residues in bulk milk after freshening
- Single infusion/qtr. recommended
  - Antimicrobial activity persists 2-4 wk
Selective Dry Cow Therapy (DCT)

• Selecting only the infected or potentially infected quarters or cows to treat

• To reduce expense, drug use, & development of antibiotic–resistant bacterial strains

• Selection based on culture, SCC (Electronic, CMT)
  – Reasonable threshold: 200,000/ml (treat >this level)

• For cows/qtrs assumed uninfected (<200,000/ml):
  – Teat sealants may prevent new infections:

  ![External → Internal →](image)
Effects of Blanket vs. Selective DCT on the prevention of new infections

- 729 low SCC cows (<200,000); 16 herds
  - 1. Blanket: All 4 qtrs received DCT + Teat seal
  - 2. Selective: Only infected cows received DCT + Teat seal based on + bacterial culture results
    - Culture-negative cows received teat seal only

Conclusion: Selectively treating culture+ cows = blanket therapy at dry off
*When SCC at dry-off are <200,000/ml

Cameron et al., 2014
Use of Internal Teat Sealants at Dry-off

- Bismuth/paraffin based
- Infused at drying-off
- + after dry cow therapy
- Removed at 1st milking

Orbeseal™
Bismuth subnitrate/mineral oil

Teatseal®
Bismuth subnitrate/paraffin oil

Physical barrier to Bacteria
Teat seals: Initial studies - United Kingdom (Huxley et al., 2002)

New infection rate with various mastitis pathogens

*Orbeseal use: 70% fewer *E. coli* IMI (*P*<0.01)

Orbeseal = DCT, but better in preventing coliform IMI
Efficacy of Orbeseal™ + DCT in 437 cows (1748 qtrs)

1. All 4 qtrs infused with DCT
2. 2 contralateral qtrs: Orbeseal

Compared with DCT alone, DCT + Orbeseal →
- 30% fewer new infections during dry period
- 33% less likely to develop clinical mastitis
- Lower SCC in early lactation
- Combination superior to DCT alone

Godden et al., 2003
Efficacy of Orbeseal™ + DCT in 949 cows (multi-herd)

1. 2 qtrs infused with DCT alone
2. 2 contralateral qtrs: DCT + Orbeseal

Compared with DCT alone, quarters treated with DCT + Orbeseal:

- 27% less likely to acquire new IMI (all pathogens) during dry period
- 38% less likely to acquire new IMI (environmentals) during dry period
- 58% less likely to acquire new IMI (coliforms) during dry period

Combination superior to DCT alone, vs. *environmentals, **coliforms

Sanford et al., 2006
Other management factors to consider

- Cooling during warm season \((H_2O/sprinklers)\)
  - ↑ comfort, DMI, immune function (↓ mastitis)
- Daily bedding maintenance/clean pasture
  - ↓ pathogen load at teat end (↓ mastitis)
- Provide proper nutrition & supplements
  - Se, Cu, Zn; Vit. A, D, E; additives (Omnigen)
    - Improve leukocyte function vs. mastitis pathogens
- Length of the non-lactating or dry period
  - 1\(^{ST}\) lactation cows: 50-60 d; Multiparous cows: 35-45 d
    - By milking high-producing cows longer (45- vs. 60-day dry period), yield will be lower when it is time to dry them off
- Vaccination against environmental mastitis…
Coliform vaccination schedule

Up to 80% effective in preventing new cases of clinical coliform IMI

Endovac bovi 2X, 2-3 weeks apart

J-VAC 2X, 2-4 wk later

Envirocore 3X, 7 & 8 mo, <2 wk calving

CALVING

DRYING OFF

DRIED PERIOD
Summary

• Proper dry-off methods DO promote udder health
• Decrease dietary energy last 1-2 wk; increase fiber
• Abrupt cessation = Intermittent milking/diet change
  – Intermittent: High producers (↓production, ↓leakage at DO)
• Dry period length- Heifers: 50-60 d; Multi: 35-45 d
  – Milk high producers longer to decrease yield (↓volume)
• Selective = Blanket for low SCC cows <200,000/ml
  – DCT + Teat seal recommended to maximize benefits
  – Use Blanket DCT for high SCC cows/herds >200,000/ml
• Use recommended infusion techniques (keratin, sphincter)
• Coliform vaccines: ↑Immunity ↓CM in early lactation
Stepping up to prevent mastitis through dry cow management
Questions?