Heifer Mastitis Management Strategies
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Southeast Quality Milk Initiative, 3rd Annual Meeting
November 3, 2015, Logan County Extension Office

Heifers: Calve with maximum yield and low SCC

Mastitis! diminishes yield/quality
Mastitis in Heifers: Outline

- Prevalence of intramammary infection
- Treatment with antibiotics

Prevention:
- Use of teat seals to prevent new cases
- Horn fly control
- Vaccination ↑ immunity
- Feed additives: improve animal health
Mastitis is not noticed until freshening or at the first clinical flare-up during lactation.

Young dairy heifers are regarded as uninfected.

Future milking herd!

(Also need an udder health program)

Mastitis is not noticed until freshening or at the first clinical flare-up during lactation.
>75% of heifers: subclinical mastitis

~20-30% of heifers: *S. aureus*  
SCC > 10 million/ml  
(Few clinical symptoms)

Breeding age: 12-15 mo and older
Future milking herd!
(Also need an udder health program)

Heifers exposed to mastitis bacteria at a young age

Breeding age
2 - 2.5 yr (¼ - ½ lifetime!)
NO MASTITIS CONTROL ➔ ↓ MILK YIELD ↑ SCC!!!!!!!

Pregnant
How do heifers get mastitis?

Intramammary infection

Teat

Bacteria

Keratin plug

Staph. aureus
75% of heifers may be infected in 60% of quarters; *Staph. aureus* is a major problem.

All infections associated with elevated somatic cell counts (SCC).
What happens inside an infected quarter?

Scar tissue formation in response to *Staph. aureus*

Reduced secretory potential

10% less milk

Lower yield during 1\textsuperscript{st} lactation and spread to the lactating herd

20,000 lb vs. 22,000 lb
Bacteria causing heifer mastitis

- **Contagious**
  - *Staph. aureus*
  - *Strep. agalactiae*
  - *Mycoplasma* spp.
  - *Corynebacterium bovis*

- **Coag.-negative staphs**
  - *Staph. chromogenes*
  - *Staph. hyicus*
  - *Staph. simulans*

- **Environmental**
  - *Escherichia coli*
  - *Klebsiella pneumoniae*
  - *Serratia* spp.
  - *Citrobacter* spp.
  - *Enterobacter* spp.
  - *Strep. uberis*
  - *Strep. dysgalactiae*
  - *Strep. faecalis*

Bred heifers: *S. aureus/CNS*

1-2 weeks prepartum
Bacteria move upward into the quarter, destroying milk-producing tissues.

The entire quarter may become nonfunctional or "Blind". Usually due to *S. aureus* or *Trueperella pyogenes*.

Bacteria enter via teat canal. If WBC fail to eliminate them, then infection is established.

Scar tissue (10% less yield)
Greatest development of milk-producing tissues is during 1st pregnancy. Protection from mastitis bacteria insures maximum milk production. If mastitis is suspected in heifers, infected quarters should be treated.
Eliminate infection: Antibiotic therapy

✅ Dry cow therapy

✅ Lactating cow therapy
Dry cow product use in heifers

- Cefa-Dri
- Tomorrow
- Dry-clox
- Albadry Plus
- Biodry
- Quartermaster
- Orbenin-DC
- Spectramast DC

Treat prior to 30 days prepartum (avoid residues)
Cure rate is 90-100% when heifers are treated during pregnancy, but treat no sooner than 30 days prepartum.

**Sanitize teat orifice, use partial insertion technique, dip teats**

Example trial….
Bacteriology of mammary secretions from pregnant Jersey heifers (n=38) sampled 16-20 wk prepartum

Owens et al., 1994

Cephapirin benzathine (300 mg) 10-12 wk pp

Treated half the qtrs. (25); remainder were controls.
Cure rate after treatment with 300 mg cephalapirin benzathine (Tomorrow)

<table>
<thead>
<tr>
<th>Bacterial species</th>
<th>Quarters treated</th>
<th>Quarters cured</th>
<th>Quarters failed</th>
<th>Percent cured</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. aureus</td>
<td>25</td>
<td>24</td>
<td>1</td>
<td>96</td>
</tr>
<tr>
<td>CNS</td>
<td>31</td>
<td>28</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>Strep. spp.</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Coliforms</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

*SCC significantly reduced 50% at calving vs. controls.
*Milk production increased by ~10% over the controls.
*Reduced spread of *Staph. aureus* to the lactating herd.
When is best time to treat?

Pregnancy checks ➔

Hoof trimming ←

Moving to close-up lot;
run through chute/treat ➔

Extra-label: Valid CPR
Lactating Cow Products

- Cefa-Lak
- Today
- Hetacin-K
- Albacillin
- Pirsegue
- Amoxi-Mast
- Dariclox
- Spectramast LC

~14 days prepartum
Any sooner results in antibiotic residues

Example trial......
73% Holstein heifers infected 2 wk prepartum
Treated with: Penicillin/novobiocin or Pirlimycin
Determined cures at calving:

Albacillin: 76% cure rate; Pirsue: 59% cure rate

Oliver et al., 2004
96% of Jersey heifers infected 2 wk prepartum

Treated with:

Penicillin/novobiocin or Pirlimycin

Determined cures at calving:

Albacillin: 75% cure rate; Pirsue: 87% cure rate
Lactational performance and SCS of antibiotic-treated and control heifers

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Actual</th>
<th>305-d</th>
<th>SCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (82)</td>
<td>11,429</td>
<td>11,011</td>
<td>2.63</td>
</tr>
<tr>
<td>Treated (111)</td>
<td>12,598*</td>
<td>12,021*</td>
<td>2.04*</td>
</tr>
</tbody>
</table>

*Differed from control ($P<0.05$)

Milk Production (lb)

Whether dry / lactating products are used, follow proper infusion method:

Oliver et al., 2004
Full Insertion:
- Stretches sphincter
- Dilates teat canal
- Removes keratin
- Introduces bacteria

Partial Insertion:
- Maintains integrity
- Minimizes bacterial entry into the gland

Prevention...
Use of Internal Teat Sealants Prepartum:

- Bismuth/paraffin based
- Infused 30 d prepartum
- Removed at 1st milking

Orbeseal™
Bismuth subnitrate/mineral oil

Teatseal®
Bismuth subnitrate/paraffin oil

Physical barrier to Bacteria

Results of NZ trial...
Total bacteria positive quarters, and quarters with *S. uberis* infections from clinical cases of teat seal and control heifers 14 d postpartum.

% qtrs. with clin. mastitis

<table>
<thead>
<tr>
<th></th>
<th>Teat seal</th>
<th>Untreated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total bacteria positive</td>
<td>26</td>
<td>84</td>
</tr>
<tr>
<td>Strep. uberis positive</td>
<td>15</td>
<td>57</td>
</tr>
</tbody>
</table>

3-fold reduction

4-fold reduction
What about teat seal AND antibiotic? Does the combination work better than either alone in dairy heifers?

Results (n=38) at calving demonstrated...

30-60 d prepartum:
1. Untreated
2. Antibiotic DCT
3. Teat seal
4. DCT + teat seal
Cure rates and prevention rates for untreated qtrs & qtrs treated with DCT and/or teat seal in 38 heifers

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cure Rate</th>
<th>Prevention Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>58.3a</td>
<td>96.2a</td>
</tr>
<tr>
<td>Antibiotic</td>
<td>100b</td>
<td>92.8a</td>
</tr>
<tr>
<td>Teat seal</td>
<td>75ab</td>
<td>96.2a</td>
</tr>
<tr>
<td>Anti + seal</td>
<td>100b</td>
<td>93.1a</td>
</tr>
</tbody>
</table>

SCC: 1,488,000
Ave SCC: 464,000

No differences among tmt

Why bother treating at all?
3 out of 4 quarters (75%) may be infected w/ bacteria

Treat all quarters with 1) DCT to **cure** existing IMI & 2) Teat seal to **prevent** the establishment of new IMI. Successful treatment will lower SCC at calving time.
Proper teat seal infusion:

1. Compress area at base of teat with hand.

2. Insert cannula using the partial insertion method.

3. Slowly infuse contents so seal remains in teat.

If teat cistern is open to gland cistern, and seal is jetted into teat, it may be placed high in the quarter and milk out for days or weeks after calving.
Horn flies not only pester heifers by feasting on blood drawn from animals’ backs...
Flies also attack heifers’ teats, causing mastitis

Horn fly  
*Haematobia irritans*

*S. aureus*-infected quarter

Bred heifer

3-month-old heifer

Cows grazing in a field.
Front teats

Scabs colonized with *S. aureus*

How do flies cause scab formation?
Horn flies live solely on blood from cows. Lifespan: 3-4 weeks.
If heifers’ teat scores are not healthy (Score 1), then a fly problem exists, and teat lesions (Scores 2 and 3) are associated with mastitis.

Herds with fly control programs have healthier teats and less mastitis.
Percentages of heifers with mastitis in herds with and without fly control (Foggers, bait, pour-ons, dust, sprays, ear tags)

- Environmental streps: 3.7% with fly control, 20.7% without fly control
- Coagulase-negative staphs: 10-fold increase
- Staph. aureus: 5.6% with fly control, 55.2% without fly control
- Total infections: 44.4% with fly control, 100% without fly control

Herds with fly control programs have much lower levels of mastitic heifers.
Use of pour-ons reduces fly populations (Every 2 wk – intensive)
Insecticidal pour-on (Eprinex) + ear tag (Patriot) reduced flies and ↓ *Staph. aureus* mastitis by 83% over a 6-month period
Insect Growth Regulators (IGR; ClariFly® Larvacide)

Fly lays its eggs

Insect Growth Regulators
Reduction in fly population

Horn Fly

Life Cycle

Larvae consume IGR

Larvacide (IGR)

Maggots

Eggs hatch

Eggs in manure

Fly control:
- Pour-on
- Ear tags
- IGR

Very effective

Pupae
Can heifers be vaccinated against Staph. aureus mastitis?

Increasing antibody titers to prevent new S. aureus infections

Lysigin, AKA Somatostaph
James River Correctional Center

- 120-cow Holstein herd
- 22,000 lb milk
- Average SCC: 200,000/ml
- ~20% *S. aureus* infection rate in heifers
- Prevention of mastitis via vaccination?
- 106 heifers 6-12 mo allotted to vaccinated and control groups (53 heifers/group)
Frequency distribution of bacterial species among heifers & quarters during pregnancy

- 68.9% CNS
- 19.8% S. aureus
- 6.6% Streps
- 1% Coliforms
- 34.3% CNS
- 9.4% S. aureus
- 2.3% Streps
- 0.3% Coliforms

½ vaccinated

96.3% Heifers & quarters vaccinated
At 6-12 mo
14 days later
At 6-mo intervals
Pre-calving

Monitored level of *S. aureus* mastitis after freshening
Percentages of heifers freshening with *Staph. aureus* infections.

- **Vaccinated**: 13.3%
- **Control**: 34%

**Minimize spread to milking herd**

60.9% Reduction ($P<0.001$)

**Immunization**: +

Other options to boost immunity?

- 50% reduction in SCC
- 8.6% increase in prod.

**Percentage of heifers with mastitis**

- **Vaccinated**: 50%
- **Control**: 8.6%

**Percentage of heifers with mastitis**

- **Vaccinated**: 10%
- **Control**: 15%

**Immunization**: +

Other options to boost immunity?
Boosting Immune System: Dietary Supplementation

- Selenium
- Vitamin E
- Beta carotene
- Vitamin A
- Copper
- Zinc

**Se & Vitamin E:**

Promote leukocyte antibacterial activity

Supplementation 60 days prepartum

Reduced staphylococcal and coliform mastitis at calving & lowered SCC

Weiss, 2002
Feed additives: Lower mastitis & SCC

2014 market survey conducted by Hoards Dairyman: 32% of US dairy managers use feed additives - yeast

OmniGen: Immune stimulation of the mammary gland

1. **Function**: Enhance somatic cell (leukocyte) antibacterial activity

2. **Level**: 56 grams per day

3. **Cost**: 13 cents per day

4. **Benefit to cost ratio**: 7:1 early lactation; 3:1 for entire lactation

5. **Time period**: Starting at drying off through 60 days postpartum

OG: Could be a practical strategy to adopt for lowering mastitis & SCC

When is the optimum time to use OmniGen?
Mastitis increases around time of calving

- **Innate immunity**: most important defense of the mammary gland.
- Relies heavily on the bactericidal function of WBC migrating from the blood.
- WBC function is compromised during the periods of immunosuppression: Cortisol.
- If WBC function could be enhanced, cows could better resist mammary infection.

Enhancing WBC?
- Vaccination
- Diet: Se+Vit E
- Diet: OmniGen?

2-4 wk prepartum to 2 wk postpartum
Period of Immunosuppression (Cortisol) (Innate immunity suppressed)
Reduced neutrophil activity
40 heifers on feeding trial to evaluate OmniGen (UGA)

- 20 supplemented with OmniGen
- 20 controls

60d prepartum
4g/100lb/day

60 Days

- WBC ability to kill mastitis bacteria
- Level of mastitis at calving
- Other health parameters

Vs. Controls
Neutrophils in heifers fed OmniGen expressed greater ability to recognize and kill mastitis-causing bacteria: *S. aureus & E. coli* compared with neutrophils from control heifers.

Greater neutrophils activity may lead to enhanced protection against mastitis during this peri-parturient period, when the cow’s immune system is suppressed.
Postpartum adverse health events among Omnigen-supplemented & control heifers

No. of heifers w/ an event

<table>
<thead>
<tr>
<th>Event</th>
<th>Supplemented</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ret. Plac.</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Displ. Abo.</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Ketosis</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Udder edema</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Culled</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>27</td>
</tr>
</tbody>
</table>

Omnigen-fed heifers: fewer adverse events (15 vs. 27)

Associated with a low mastitis rate?
Supplemented and control heifers with new IMI on days 3 and 10 postpartum

OmniGen-fed heifers: fewer new infections

% Heifers with new IMI

Ave # new IMI per quarter

Supplemented  Control

0.36  0.5  P=0.46

0.36  0.93  P=0.09
Reductions in adverse health events & new cases of mastitis suggest an advantage for OmniGen-fed heifers.

OG ➞ Ameliorated the suppression of immunity at calving.
Young calves

Pregnant

• All susceptible to mastitis!

Future milking herd:

$Huge Investment$

• Need a prevention program
• Need a treatment program

Fly control
Vaccination
Teat seal +/-
Dietary suppl.

Prevention not 100%

Dry cow tmt/
Lact. cow tmt

Goal

SUMMARY

All susceptible to mastitis!

• Freshen free of mastitis
• Low somatic cell counts
• Maximum milk production $$
Platinum
Multimin USA
Zoetis

Gold
Elanco
Maryland-Virginia Producers Cooperative Association

Silver
CPC Commodities
Kentucky Dairy Development Council

Contributor
Bluegrass Dairy and Food, Inc.

DFA– Mid-East
DFA– Southeast
W.D. Hoard & Sons

Thank you for your support!
THANK YOU

The End

Questions?