MANAGING SOMATIC CELLS COUNTS IN COWS AND HERDS

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Mastitis

- Bacterial infection of the udder
- 99% occurs when bacterial exposure at teat end exceeds ability of immune defenses of cow

- Subclinical mastitis
  - Milk appears normal but contains excessive numbers of inflammatory cells
  - Individual Cow SCC values provide good data for monitoring

- Clinical mastitis
  - Visual abnormalities of milk
  - Definition varies among farms

Clinical Mastitis & Subclinical Mastitis

Problems are Often Linked

Somatic Cells in Milk Indicate the Presence of Cows with Subclinical Mastitis Infections

There is no way to know how many cows are infected without performing an individual cow SCC test

Somatic Cells are NOT Affected by:

- Breed
- Milk yield — unless < 7 kg/cow/day
- Stage of lactation — unless there are more infected cows in later lactation
- Nutritional management — unless diet results in very loose feces and dirtier cows
- Other cow diseases

Somatic Cell Count ARE Affected by

- Management practices that expose teats to bacteria that cause mastitis
  - In milk that came from infected udders of cows
    - Exposure to contagious bacteria
  - In the environment that the cow lives in
    - Exposure to environmental bacteria
**Somatic Cells in Milk**

- SCC composed of white blood cells & occasional dead epithelial cells
- Macrophages are predominant cell in healthy gland
  - Provide surveillance & initiate inflammatory response
- 90% of SCC in infected gland are neutrophils

**How Somatic Cells Get into Milk**

- Blood Flow through Mammary Tissue
- Increases To >90%

**Distribution of Cells in Normal Milk**

<table>
<thead>
<tr>
<th>Neutrophil</th>
<th>Macrophage</th>
<th>Lymphocyte</th>
<th>Epithelial</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>90%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
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<tr>
<td>80%</td>
<td>20%</td>
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<tr>
<td>70%</td>
<td>30%</td>
<td>0%</td>
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<tr>
<td>60%</td>
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<tr>
<td>50%</td>
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<tr>
<td>40%</td>
<td>60%</td>
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<tr>
<td>30%</td>
<td>70%</td>
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<td>100%</td>
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</tr>
</tbody>
</table>

**Mastitis is Based on Detection of Inflammation NOT INFECTION**

- We are detecting the Results of the Immune Response!

**Inflammatory Process Reduces Milk Value**

- Injury to secretory cells reduces synthesis of lactose, fat & protein
- Increased permeability of cell membranes allows leakage of blood components into milk
- Reduced shelf life

**SCC of Milk from Healthy Udders is Low and Consistent**

- SCC of 200,000
  - $123,760 USD per year
  - $184,960 per year

**Inflammatory Process Reduces Milk Yield**

- USD $ Loss for 1000 cows
  - 30% 1st parity
  - 70% >2nd parity
  - $0.40/liter
- SCC of 200,000
  - $123,760 USD per year
- SCC of 400,000
  - $184,960 per year

**How SCC are detected**

- SCC of >200,000 cells/ml have 1 or more quarters with subclinical mastitis
- Heifers should be <100,000

**SCC of 2 Quarters of 1 cow**

- SCC of 200,000
  - 1400
  - 1600

**SCC of Cow**

- SCC of 1000
  - 200
  - 400
  - 600
  - 800
  - 1000
  - 1200
  - 1400
  - 1600

**SCC of Cow (cells/ml x 1000)**

- Lactose
- Casein
- Fat

**Kilograms of Milk Lost per Lactation**

- 0
- 100
- 200
- 300
- 400
- 500
- 600
- 700
- 800
- 900
- 1000

**Infected Quarter vs Healthy Quarter**

- Infected Quarter
- Healthy Quarter

**Survey of 4,213 bact. negative quarters**

- SCC of 29,000 cells/ml

**Survey of 4,213 bact. negative quarters**

- SCC of 29,000 cells/ml

Schallibaum, NMC 2001

**Adapted from Burton & Erskine, Vet Clinics Food Anim Pract, 2003**

**Raubertas & Shook, 1981**

**Harmon, NMC 2001**

**Harmon, JDS 1994**

**Raubertas & Shook, 1981**
**Somatic Cell Count DHIA Thresholds**

- Individual cow SCC values are comiled milk from all 4 quarters
- The SCC of a cow with a SINGLE infected quarter may be quite low
  - Causes variation in SCC values

**Subclinical Mastitis is Usually Caused by Gram Positive Bacteria**

- Cultured >5600 milk samples from 40 herds with BTSCC >250,000 cells/ml
- Only 1% were Gram negative

**Bulk Tank versus Individual Cow SCC**

- BTSCC measures the combined SCC of milk put in the tank
- Easily manipulated
  - Withholding of quarters
  - Detection of clinicals
  - Use or lack of use of forestripping
- Individual cow SCC values are REQUIRED for solving herd mastitis problems

**When did this heifer likely first develop mastitis?**

- Subclinical Mastitis is Usually Caused by Gram Positive Bacteria
  - Cultured >5600 milk samples from 40 herds with BTSCC >250,000 cells/ml
  - Only 1% were Gram negative

**When the SCC is High Does it Mean that you can find bacteria in the milk?**

- Prevalence of IMI or High SCC
  - Dry Off Calving First Test Chronic New “Cured”
  - Bacteriology positive
  - Quarter SCC >200k
  - Only 1% were Gram negative

**Evaluating Herd Problems**

<table>
<thead>
<tr>
<th>Cow</th>
<th>SCC (x1000)</th>
<th>Milk (kgs)</th>
<th>WT.SCC Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>25</td>
<td>5000</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>25</td>
<td>5000</td>
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<tr>
<td>3</td>
<td>100</td>
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<tr>
<td>4</td>
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<td>25</td>
<td>5000</td>
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<tr>
<td>9</td>
<td>100</td>
<td>25</td>
<td>5000</td>
</tr>
</tbody>
</table>

- Estimated BTSCC: 247,500/300 = 825 (x1000) cells/ml
- BTSCC = 825,000
- Prevalence of Infection is 10%
Evaluating Herd Problems
Prevalence of Infection

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<tr>
<td>9</td>
<td>500</td>
<td>25</td>
<td>25,000</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
<td>75</td>
<td>15,000</td>
</tr>
</tbody>
</table>

Estimated BTSCC: \( \frac{129,000}{300} = 400 \text{ (x1000) cells/ml} \)

Identification of Subclinical Infections

A history of SCC is more informative than data from 1 or 2 test days

Key Performance Indicators
Subclinical Mastitis

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<tr>
<th>Indicator</th>
<th>Calculation (based on monthly tests)</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence (proportion of currently affected)</td>
<td>Number of cows with SCC&gt;200,000 cells/ml/number of cows with SCC</td>
<td>&lt;15% of lactating cows</td>
</tr>
<tr>
<td>Incidence (new infections)</td>
<td>Number of cows with SCC&gt;200,000 cells/ml for the first time in the time period/number of cows with SCC below 200,000 in previous time period</td>
<td>&lt;5% if determined based on 1st SCC&gt;200k in the lactation up to 8% if based on month to month changes in SCC</td>
</tr>
<tr>
<td>Prevalence at 1st DHIA test</td>
<td>Number of cows with SCC&gt;200,000 cells/ml at 1st monthly test/number of cows with 3rd SCC tests</td>
<td>&lt;5% of 1st lactation</td>
</tr>
<tr>
<td>Prevalence at last DHIA test before dry off</td>
<td>Number of cows with SCC&gt;200,000 cells/ml at last test before dry off/number of cows with last DHIA test</td>
<td>&lt;30% of cows with last test date SCC</td>
</tr>
</tbody>
</table>

Environmental Mastitis Herd

No real Inc. with Days in milk

Moderately high prevalence

Practical Methods to Improve Milk
Bulk Tank SCC

1. Work with advisors to implement an annual udder health plan
2. Focus on prevention of new infection – NOT treatment after infection occurs
3. Identify and manage chronically infected COWS

Make an Annual Udder Health Plan

- Identify a farm management team of advisors to help solve the problem
- Have a monthly meeting of the advisors to focus specifically on SCC
- Develop
  - Goals for SCC
  - Actions & ways to assess the actions
  - Responsibilities for each team member
  - Target Dates to complete the actions
  - Times to meet to evaluate progress
Prevention of Mastitis
Successful Implementation of the 5 Pt Plan

1. Effective teat dipping
   1. 97% of farms dip but many do not dip effectively
2. Dry cow therapy of all quarters of all cows
   - To treat subclinical infections present at dry off
3. Appropriate treatment of clinical cases
   - Record all cases
   - Monitor outcomes
4. Culling chronically infected cows
5. Regular milking machine maintenance
   1. Stable teat end vacuum

Each farm needs a Milk Quality Plan

- It is always more cost effective to prevent mastitis than to treat mastitis
- The development of a chronic cow is an indication of failure
  - Prevention
  - Detection
  - Treatment

Options for Handling Chronic Mastitis

Treat, Segregate, Dry off Cow, Dry off quarter, Quarter milk or Cull

Treatment of Subclinical Mastitis

- It is almost NEVER cost effective to solve subclinical mastitis problems through treatment during lactation
- EXCEPT for Streptococcus agalactia
Net Profit by Cure Rate For Treatment of Subclinical Mastitis

Barely Profitable
Swinkels et al, JDS 2005

Segregation of Chronically Infected Cows
- Spread occurs when healthy udders contact infected milk from chronically infected quarters
- Separate healthy cows from infected cows
  - or use of separate milking equipment
- Must use SCC values to identify infected cows and milk last

Effect of Segregation
- Effect of segregation or identification of infected cows and the use of separate milking studied
  - 76 herds in New York
  - 6 - 24 month period
- Percentage of infected cows in a control group was not reduced

Permanent Dry Off of Selected Quarters
- Chronically infected quarters can be permanently dried off
- Reduced shedding of bacteria from infected glands
  - Decrease exposure and new infection rate
- Reduces shedding of SCC into saleable milk
- Requires veterinary supervision
  - Extralabel drug usage

Therapeutic Cessation of Lactation
- 14 mid-late lactation cows with chronic single quarter infections
  - Staph aureus
- Intramammary Treatments
  - 120 ml of 0.5% povidone-iodine
  - 120 ml of Chlorhexidine
- All cows received 600 mg Banamine
- Treated quarters were not milked for rest of lactation
- Milk production & return to lactation assessed in next lactation
- Povidone iodine caused permanent end of lactation
- 71% of quarters that received Chlorhexidine returned to lactation
- Cessation of lactation did not affect milk yields in 1st week of lactation

Middleton & Fox, 2001

Isolation of Infected Quarters
- Principle is to reduce cross-contamination of equipment and to reduce SCC of bulk tank milk
- “Quarter Milker” allow collection and discard of high SCC milk from infected quarters
- Quarter milkers do NOT:
  - Cure mastitis
  - Cannot be used to keep antibiotics out of bulk tank
  - Antibiotics spread throughout the whole udder and contaminate all milk
- Must be washed and dried after each milking
Quarter Milking

- A band aid
- Useful to manage bulk tank SCC for short term
  - While implementing long term preventive strategies
- Can be risky
  - Keep infected cows in herd

- Quarter milk
  - Cows with chronic long term infections that are very high producers
  - Mild clinicals that have failed to respond to treatment
  - Single quarter subclinicals

Cull Some cows

- Mycoplasma bovis infection
- Chronic Staph aureus infections
- Multiple quarters with recurrent infections
- Cows with more than 3 clinical cases
- Teat end damage
- Older cows with history of chronic mastitis

Solving Mastitis Problems

- Technically easy
  - Keep bacteria away from teats
- Find the infected cows
  - Decide what to do with them
    - Treat them or EAT them
- Determine why they get infected
  - What is the source of infection
    - Other cows or environment?
- Decide how to stop new infections
  - What management changes need to occur?

- Herds can reduce subclinical mastitis by adopting recommended best management practices
- Key to improvement is to
  - Know which cows are infected with subclinical mastitis
    - Prevent new infections
    - Develop and implement an annual milk quality plan

For more information:
http://milkquality.wisc.edu