**Bovine Mastitis**

John Swain Fall 2018

References from Dr. Bhushan Jayarao- Ex. Vet. Penn State Univ.

Dr. Larry Fox, Washington State Univ.

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Mastitis Management- Who on the farm needs to be involved???

- Milkers
- Housing Maintenance personnel
- Milk Equipment Maint. Personnel
- Operation Supervisor

- Mastitis cannot be eliminated. It can be controlled
- People control mastitis- TEAM EFFORT

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What’s mastitis ?

- Inflammation of one or more quarters of the udder

Mammae = breast

-itis = Latin suffix for inflammation

Normal

- Swelling
- pain
- warm
- redness

Inflamed
What's the significance of bovine mastitis?

- Causes significant economic losses to the dairy industry in the US
  - $200/cow/year
  - $2 billion/year

The most costly disease affecting dairy cattle throughout the world.

What are the health concerns of mastitis?

- Animal health
  - Loss of functional quarter
  - Lowered milk production
  - Death of cow
- Human health
  - Poor quality milk
  - Antibiotic residues in milk

How severe can mastitis be?

<table>
<thead>
<tr>
<th>Subclinical Mastitis</th>
<th>Clinical Mastitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>~ 90-95% of all mastitis cases</td>
<td>~ 5 - 10% of all mastitis cases</td>
</tr>
<tr>
<td>Udder appears normal</td>
<td>Inflamed udder</td>
</tr>
<tr>
<td>Milk appears normal</td>
<td>Clumps and clots in milk</td>
</tr>
</tbody>
</table>
| Elevated SCC (score 3-5) | **Acute type**
| Lowered milk output (~ 10%) | - major type of clinical mastitis
| Longer duration | - bad milk

**Acute type**
- Loss of appetite
- Depression
- Prompt attention needed

**Chronic type**
- Bad milk
- Cow appears healthy

RIP
What causes mastitis?

- Bacteria (~ 70%)
- Yeasts and molds (~ 2%)
- Unknown (~ 28%)
  - physical
    - trauma
    - weather extremes

Where do these organisms come from?

- Infected udder
- Environment
  - bedding
  - soil
  - water
  - manure
- Replacement animals

How does mastitis develop?

- Cow
  - Predisposing conditions
    - Existing trauma (milking machine, heat or cold, injury)
    - Teat end injury
    - Lowered immunity (following calving, surgery)
    - Nutrition
- Organisms
- Environment
Mastitis

- Mammary Immune system
  - Skin and keratin lining - 1st line of defense
  - Cellular - 2nd line of defense
    - Leukocytes
      - PMNs - phagocyte-engulfment and destroy
      - Macrophages - phagocytic
      - Lymphocytes - antibody producers + cytokine (hormones of the immune system)

Process of infection

- Organisms invade the udder through teat canal
- Migrate up the teat canal and colonize the secretory cells
- Colonized organisms produce toxic substances harmful to the milk producing cells

The cow’s immune system send white blood cells (Somatic cells) to fight the organisms

recovery clinical subclinical
Mastitis

- **Environmental** bacterial pathogens
- **Contagious** bacterial pathogens

Identification of the bacteria and where it came from is critical to mastitis treatment. Minimizing exposure is key to mastitis management.

Mastitis

- Bacterial physiology
  - A. Gram + (thick cell wall membrane)
  - B. Gram – (thin cell wall membrane)

Gram stain to determine category of pathogen.

**BACTERIA**

**Streptococci**

- **Environmental**
  - *S. uberis*
  - *S. dysgalactiae*
  - *S. equinus*

- **Contagious**
  - *S. agalactiae*
  - Gram +

- More subclinical mastitis
- Environment
- Predominant early and late lactation
- Clinical mastitis
- Cannot live outside the udder
- Treated easily with penicillin
BACTERIA

Staphylococci

- **Staph. aureus**
  - Summer mastitis
  - Spread by milking equipment and milker’s hands
  - Persistent, difficult to eliminate
  - If unattended leads to chronic mastitis

- **Other Staph**
  - Found normally on skin
  - Lowers milk yield
  - Elevated SCC
  - Easily responds to antibiotics
  - Relapse frequently seen

Field language

“Staph”
“Staph. Mastitis”

BACTERIA

Coliforms

- Groups of organisms
  - *E. coli*, *Klebsiella*, *Enterobacter*
  - *Gram -*

- Environmental source (manure, bedding, barns, floors and cows)

- Coliforms cause acute clinical mastitis
  - high temp, and inflamed quarter
  - watery milk with clots and pus
  - toxemia

Other organisms

- *Pseudomonas aeruginosa*
  - outbreaks of clinical mastitis

- *Serratia*
  - outbreaks of clinical mastitis

- *Corynebacterium pyogenes*

- Fungi
  - *Mycoplasma bovis*(non treatable and very contagious)
How is mastitis diagnosed?

- Physical examination
  - Signs of inflammation
  - Empty udder
  - Differences in firmness
  - Unbalanced quarters

- Cowside tests
  - California Mastitis test
  - Electrical Conductivity

Mastitis

- Leucocytes are the cell that leave the blood and enter the milk to destroy bacteria. They are the cells that chiefly make up the milk somatic cell count (scc).
- As scc increase, so does the likelihood of bacterial infection as more cells are moving into milk to fight the infectious agent.

Mastitis

- CMT- scc>200,000 cells/ml indicate that intramammary infection is probably present.

<table>
<thead>
<tr>
<th>Score</th>
<th>Scc (cells per ml)</th>
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<tbody>
<tr>
<td>Neg</td>
<td>0-200,000</td>
</tr>
<tr>
<td>Trace</td>
<td>150,000-500,000</td>
</tr>
<tr>
<td>1</td>
<td>4,000 – 1,500,000</td>
</tr>
<tr>
<td>2</td>
<td>800,000 -5,000,000</td>
</tr>
<tr>
<td>3</td>
<td>&gt;5,000,000</td>
</tr>
</tbody>
</table>
Mastitis

- Scc x1000  | Linear score | Milk loss  
- 0-12.5     | 0            | 17,124 lbs.  
- 12.5-25    | 1            | 16,724      
- 25-50      | 2            | 16,324      
- 50-100     | 3            | 15,924      
- 100-200    | 4            | 15,524      
- 200-400    | 5            | 15,124      
- 400-800    | 6            | 14,724      
- 800-1,600  | 7            | 14,324      
- 1,600-3,200| 8            | 13,924      
- 3,200-6,400| 9            | 13,524      
- 6,400-12,800| 10          | 13,124      
- 12,800-25,600| 11         | 12,724      
- U of Wisconsin 1995

Mastitis

- Electrical Conductivity
  - Leakage of blood components
    - Proteins
    - Ions – chloride (salts increase conductivity)

How is mastitis diagnosed?

- Culture analysis
  - The most reliable and accurate method
    - costly ($5-12)
How do you treat mastitis?

**Clinical mastitis**
- Strip quarter every 2 hours
- Oxytocin valuable
- high temp, give aspirin
- Seek veterinary assistance
- Treatment with penicillins

**Subclinical mastitis**
- Questionable

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### THE 10 STEPS TO MASTITIS CONTROL

**ONE: Prepare cows properly for milking**
- Udder preparation is pre-dipping with a dip labeled for pre-dipping. Pre-dips lower the risk of new infections by 70% !!!!!!!!!!!!!!!!
- Pre-dips
  - Iodophors 0.0 - 1.0%
  - Chlorhexidine 0.2%
  - Quats 0.5%
  - LDBSA 0.2%
  - Hypochlorous acid
  - Bleach ?
- Use single service paper towels, dry teats before machine-application.

**TWO: Have a good milking system**
- Milking equipment should be adequate in size, functioning properly, and regularly cleaned and maintained
- Correctly use proper functioning milking machines and properly prepare udders
  - Attach teat cups after thorough cleaning and drying of teats
  - Provide stable vacuum
  - Check for slipping of teat cup liners
  - Shut off vacuum before removing teat cups.
THREE: Apply and remove machine carefully
- Properly adjust to prevent liner slippage.
- Remove machine when cow is milked out, shut off vacuum at claw before removal.

FOUR: Dip each teat after each milking using a germicidal teat dip.
- Post-dips seal the teat ends temporarily for 6 to 8 hours
- A must for long term mastitis control program

FIVE: Monitor your mastitis score (DHI-SCC, WMT) regularly. Take action when significant increases occur.

SIX: Treat clinical cows, follow label recommendations, treat aseptically. Withhold treated cows' milk from milk supply.

SEVEN: Segregate chronic mastitis cows, milk them last, cull when necessary.
- Cows with chronic mastitis serve as reservoirs of organisms and could infect susceptible cows

EIGHT: Dry treat each quarter using partial insertion techniques with an approved dry cow treatment at drying off.
- Cure rate is twice high as that during lactation
- Lowers the risk of clinical and subclinical mastitis during subsequent lactation

NINE: Keep cows clean, udders free from soil and manure.
- Fence off wet, swampy areas.
- Keep free stalls and stanchions bedded properly.
- Keep calving areas clean, properly bedded (straw preferred).

TEN: Properly feed and care for cows.
Milking Procedures

1. Clean udder of debris
2. Strip 3-4 squirts of milk from each quarter
   a. Look for mastitis
   b. Stimulation
3. Pre-dip
4. Dry teats
5. Attach milking unit
6. Automatic take-off
7. Post-dip teats

Summary

- Mastitis is primarily a management problem
- Mastitis can be controlled
- Prevention programs work best when correctly followed

Milking Procedures for Quality Milk
Milking Procedures for Quality Milk

**PREREQUISITES**

- Maintain clean, well ventilated bedded areas for cows
- Segregate known infected cows. Milk them last or with designated equipment
- CMT all fresh cows by the 6th milking
- Milk all treated cows last
- Change rubber inflations every 60 days or 1000 cow milkings whichever comes first

**PREREQUISITES**

- Check the milking systems or units periodically for function and reliability
- Clip or singe the udder hair
- Examine periodically teats and teat ends
- Mastitis treatments should be done by one or two persons and should be done after milking
- Cloth towels should be washed after every use

**Simple Steps**

“Two trips to each cow will provide a routine to Maximize Milk Quality and Parlor Performance” — Dr. Andy Johnson

**Simple Steps**

Step One………Strip and Predip

Step Two………Dry and Apply
**Standardized Milking Procedures**

**Stanchion / Tiestall**
- Wear Gloves
- Wipe off excess dry manure, straw and bedding
- Strip each teat into a strip cup
- Dip teats with an approved pre-dip
- Allow the pre-dip to react for at least 30 sec.

**Parlor**
- Wear Gloves
- Wipe off excess dry manure, straw and bedding
- Strip each teat into a strip cup
- Dip teats with an approved pre-dip
- Dip 3-4 cows
- Allow the pre-dip to react for at least 30 sec.

**Stanchion / Tiestall**
- Clean teat and teat ends using single paper towel or individual towel cloth
- The teats must be dried for at least 15 sec
- Attach milking machines immediately after teats are dried
- Dip teats with post-dip immediately after milking

**Parlor**
- Return to the first cow and clean teat and teat ends using a single paper towel or individual towel cloth
- The teats must be dried for at least 15 sec
- Attach milking machines immediately after teats are dried
- Dip teats with post-dip immediately after milking

**Steps involved in employing HACCP-based concepts for establishing proper milking procedures**

**STEP ONE**
- Educate owners and milkers about implementing a standardized milking procedure (Benefits !!!!!!)
- IF a dairy farm initiates and shows sustained interest
  - Establish ground rules
  - They will have to be proactive and adopt changes
  - TEAM EFFORT !!!

*EACH STEP IS A CRITICAL POINT !!!!!!!*
- **STEP TWO**
  - Establish a team (owner, milkers, veterinarian, facilitator)
  - Mission statement
  - Goals and timeline
  - Written Procedures
    - Protocols
    - Critical Limits (SCC > 250,000)
  - Recording Keeping
    - Milking time/milking
    - Bulk Tank Temp; end of 1 hr of milking
    - Sanitation
  - Schedule team meetings to review the process

- **STEP THREE**
  - Train milkers and owners in implementing the standardized milking procedure

- **STEP FOUR**
  - Monitor the application of the standardized milking procedure
    - Floor tests (each step is a critical point !)
    - Laboratory tests (SPC or BTSCC)
    - Monitor records

- **STEP FIVE**
  - Establish corrective actions to be implemented if milk quality critical limits have exceeded.