Mastitis & Mastitis Control

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2009
What’s mastitis?

- Inflammation of one or more quarters of the udder

Normal

- Swelling
- Pain
- Warm
- Redness

Inflamed

Mammae = breast

-itis = Latin suffix for inflammation
Economic Impact

- Generally considered the most costly disease of dairy cattle
- Economic losses due to mastitis have been estimated to cost dairy producers in the US $1.8 billion annually
- Estimated cost $200-300/cow
Economic Impact

The economic losses due to:

- Decreased milk production
- Treatment costs
- Discarded milk
- Death/Culling
- Veterinary expenses
- Cost of violative antibiotic residues
<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEATH and Premature CULLING</td>
<td>14%</td>
</tr>
<tr>
<td>Discarded MILK</td>
<td>8%</td>
</tr>
<tr>
<td>TREATMENT</td>
<td>8%</td>
</tr>
<tr>
<td><strong>70%</strong> Reduced MILK Production</td>
<td></td>
</tr>
</tbody>
</table>
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
Mastitis Classification

Mastitis

Ways of Transmission
- Contagious
- Environmental

Severity
- Subclinical
- Clinical
Mastitis Classification; Severity

Clinical

Subclinical
Mastitis Classification

**Severity:**

- **Clinical mastitis**
  - Abnormal milk, gland swelling, and/or illness
  - A reasonable goal for the incidence is \( \leq 3 \) new cases/100 cows/month

- **Stages of clinical mastitis**
  - **M1** - Changes in the milk (Clots, flakes, clumps, or discoloration)
  - **M2** – Changes in the milk + udder swelling, heat or pain
  - **M3** – Changes in the milk + udder changes + systemic illness
Mastitis Classification

- **Subclinical mastitis**
  - Normal milk with an increase in somatic cell count (SCC)
    - Normal SCC in uninfected cow is < 200,000 cells/mL
  - Common herd goals for subclinical mastitis are:
    - <15% of cows with SCC > 250,000 cells/ml (prevalence)
    - < 5% of cows developing new subclinical mastitis infections per month (incidence)
Mastitis Classification

Way of Transmission:

- Contagious mastitis
  - *Staphylococcus aureus*
  - *Streptococcus agalactiae*
  - *Mycoplasma bovis*
  - *Corynebacterium bovis*
Mastitis Classification

- **Environmental mastitis**
  - *Streptococci* and *Streptococci*-like organisms
    - *Strep. uberis, Strep. dysgalactiae, Enterococcus sp.*
  - Coagulase-negative *Staphylococci*
    - *Staph. hyicus, Staph. epidermidis, Staph. simulans*
  - **Coliforms**
    - *E.coli, Klebsiella pneumoniae, Enterbacter*
  - **Gram-negative noncoliforms**
    - *Pseudomonas sp., Serratia sp, and Proteus*
Contagious Mastitis

- Spread by milking procedures, contaminated machinery, and the hands of milkers
- The primary reservoir is infected udders
- Subclinical mastitis is most commonly associated with contagious pathogens
Staph aureus

- Invasive, damage the teat and gland cisterns, abscess formation, scar tissue
- Produces toxins, enhancing its disease-producing properties (coagulase, and hemolysins)
- Intermittent shedding, very low numbers
- Mainly subclinical and chronic mastitis, some acute clinical cases
- Peracute form is less common; leads to gangrene of involved quarter
- Diagnosis by culturing; requires serial samples
Staph aureus

- Suspected in herds with older cows, high SCC and low culling rates
- Poor cure rate (20-30%)
- Dry cow therapy 60% to 70% cure rate
- Resistance to penicillin

Prevention


Staph aureus

- **Prevention:**
  - maintain milking machine
  - Proper post-dipping
  - Dry cow therapy
  - Identify Staph cows
  - Cull chronic cows
  - Segregate staph cows
  - Avoid purchasing Staph cows
Streptococcus agalactiae

- Obligate udder pathogen
- Primarily causes subclinical mastitis
- Clinical cases usually mild
- Shed in high numbers
- Highly elevated bulk tank SCC (>2 million cells/ml)
- One infected cow in 500 will be detectable in BTM culture
- Cure rate > 90%, lactational and dry therapy
  - Treated easily with penicillin
Streptococcus agalactiae

- Easily eradicated through:
  - “Blitz” treatment or dry cow therapy
  - Good hygiene
  - Teat dipping
- Prevention as for Staph aureus
Mycoplasma bovis

- Also causes pneumonia, otitis interna & arthritis in calves
- Suspected when milk samples from cows with clinical symptoms are negative after repeated culture using standard microbiologic methods
- In clinical cases, often will initially see mastitis in one quarter that spreads to other quarters in 1-3 days
- "Coffee-grounds" appearance to milk
Mycoplasma bovis

- Rapid transmission among the herd
- Shed in very high number
- 1 in 1,000 will cause positive BTC
- Marked reduction in milk yield
- Requires special media
- Usually introduce to the herd via purchased replacement animals
- Resistant to antibiotic therapy
Mycoplasma bovis

- Prevention
  - Test before entering milking herd
  - Prevent new infections, rigid milking hygiene
  - Identify infected cows, whole herd culture
  - Positive cows, segregated or culled
Corynebacterium bovis

- Causes modest increase in the SCC
- Rarely causes clinical mastitis
- Easily prevented by postmilking teat dip
- Highly susceptible to dry cow therapy (>90%)
- Credited with:
  - maintaining a higher than normal SCC and
  - increasing the resistance of the colonized quarter to invasion by a major pathogen
The primary reservoir is the dairy cow’s environment (i.e. bedding, water, soil,…)

Associated with clinical mastitis, as well as subclinical cases

Lack of hygiene
Environmental Streps

- Organisms found on skin, mucous membranes, and gut
- 50% of the infection develops at dry period
- 50% of infections become mild clinical infections
  - More subclinical mastitis
- Predominant early and late lactation
- Herd monitoring - culturing high SCC cows and clinicals
- Lactational therapy – 50-60% cure rate
- Extended treatment – higher cure rate
- Dry cow therapy eliminates most existing infections
Environmental Streps

Prevention:

- Milk clean cows
- Effective pre-dipping, adequate kill time
- Limit water use
- Good teat end condition
- Avoid overmilking:
  - Properly adjusted take-offs
- Effective dry cow program
- Teat sealants
Coliforms

- Unusual to cause persistent infection (< 2%)
- Do not usually contribute much to SCC
- High proportion of new infections occur during the 2 wks after drying off and the 2 wks before calving
- During lactation, susceptibility is highest at calving and decreases as lactation advances
Coliforms

- 40% will become clinical
- Clinical signs caused mainly by endotoxins
  - high temp, and inflamed quarter
  - watery milk with clots and pus
  - toxemia
- May cause sever toxic mastitis (10%)
- Most infections eliminated without clinical signs
- Monitor by culturing milk from new clinical cases
Coliforms

- Prevention
  - Hygiene and sanitation
  - Milk clean, dry udder
  - Vaccination

- Treatment:
  - Systemic support
    - NSAIDs
    - IV fluids
    - Frequent stripping
      - Oxytocin
  - Antibiotics ??
Coagulase-Negative Staphylococci

- *S. hyicus, S. epidermidis:*
  - Skin flora opportunists
  - Rarely cause clinical mastitis
  - Account for 60% of infections at first parturition
  - Spontaneous cure rate in early lactation (40%)
  - Teat dipping, dry cow treatment
Gram-negative noncoliforms

- *Pseudomonas:*
  - Commonly found in water and wet bedding
  - Chronic infections, no response to antibiotic therapy
  - Infected cows are frequently culled

- Prevent by
  - Reducing exposure to contaminated water
  - Clean dry bedding
Gram-Negative Noncoliforms

- *Nocardia, Candida:*
  - Often secondary to unsanitary infusion techniques or contaminated infusion products

- *Bacillus spp:*
  - Has been associated with contaminated antibiotic preparations
Gram-Negative Noncoliforms

- *Serratia marcescens:*
  - has been associated with contaminated water supplies and contaminated teat dips
  - Some strains resistant to germicides containing chlorhexidine gluconate
  - Respond poorly to antibiotics
Mastitis Diagnosis

- CMT
- SCC reports
- Strip cup
- Milk conductivity
- Bacterial culture
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Suggested meaning</th>
<th>Description of visibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Negative</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>T</td>
<td>Trace</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>1</td>
<td>Weak positive</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>2</td>
<td>Distinct positive</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>3</td>
<td>Strong positive</td>
<td><img src="image5.png" alt="Image" /></td>
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</tbody>
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Mastitis Diagnosis

- CMT
- SCC reports
- Strip cup
- Milk conductivity
- Bacterial culture
<table>
<thead>
<tr>
<th>CMT Score</th>
<th>Visible Reaction</th>
<th>SCC Range cells/mL</th>
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</thead>
<tbody>
<tr>
<td>Negative</td>
<td>No evidence of precipitate</td>
<td>0-200.000</td>
</tr>
<tr>
<td>Trace</td>
<td>Slight precipitate</td>
<td>200.000 - 500.000</td>
</tr>
<tr>
<td>1</td>
<td>Distinct precipitate</td>
<td>500.000 – 800.000</td>
</tr>
<tr>
<td>2</td>
<td>Mixture thickens immediately</td>
<td>800.000 – 5,000.000</td>
</tr>
<tr>
<td>3</td>
<td>Gel forms</td>
<td>&gt;5,000.000</td>
</tr>
</tbody>
</table>

Table 1, Interpretation of California Mastitis Test (CMT)
Mastitis Diagnosis

- CMT
- SCC reports
- Strip cup
- Milk conductivity
- Bacterial culture
Mastitis Diagnosis

- CMT
- SCC reports
- Strip cup
- Milk conductivity
- Bacterial culture
• Handheld Electrical Conductivity Tests

• In-line Electrical Conductivity Tests
Mastitis Diagnosis

- CMT
- SCC reports
- Strip cup
- Milk conductivity
- Bacterial culture
Sampling technique

CMT
Pre-dip
Dry
Alcohol swab
Strip
Take sample

One squirt is enough
Keep on ice
Milk samples freeze OK
Mastitis Treatment

- Treat clinical cases during lactation
- Treat subclinical cases at dry off
- Dry treat all the cows
- Coliforms, supportive therapy
- Use intramammary products as primary treatment
Mastitis Treatment

- Intramammary infusion products
  1. the quick-release, short-acting types designed specifically to treat mastitis in lactating cows
  2. the slow-release, long-acting types formulated specifically to treat subclinical mastitis in dry cows and to prevent new infections in dry cows: remain in the udder for $\geq 21$ days
ToDAY
cephapirin sodium
One-Day Treatment
LACTATING COWS

Contains 12 x 10 mL syringes and 12 alcohol pads. Each syringe contains 200 mg of cephapirin activity as cephapirin sodium.

FOR INTRAMAMMARY INFUSION
FOR LACTATING COWS ONLY
NADA 97-222, Approved by FDA

ToMORROW
cephapirin benzathine
DRY COW

Contains 12 x 10 mL syringes and 12 alcohol pads. Each syringe contains 300 mg cephapirin activity as cephapirin benzathine.

FOR INTRAMAMMARY INFUSION
INTO THE DRY COW
NADA 108-114, Approved by FDA
Figure 5-2. Partial insertion minimizes the risk of pushing bacteria into the udder.