

National Mastitis Council

A Practical Look at Contagious Mastitis

Introduction

Pathogenic microorganisms that most frequently cause mastitis can be divided into two groups based on their source: environmental pathogens and contagious pathogens. The major contagious pathogens are *Streptococcus agalactiae*, *Staphylococcus aureus*, and *Mycoplasma* spp. With the exception of some mycoplasmal infections that may originate in other body sites and spread systemically, these three organisms gain entrance into the mammary gland through the teat canal. Contagious organisms are well adapted to survival and growth in the mammary gland and frequently cause infections lasting weeks, months or years. The infected gland is the main source of these organisms in a dairy herd and transmission of contagious pathogens to uninfected quarters and cows occurs mainly during milking time. This fact sheet will describe the characteristics of the major contagious intramammary infections, management efforts and specific control procedures to reduce new infection rates with these organisms, and a step-by-step control program for contagious mastitis.

Organisms

Streptococcus agalactiae

Streptococcus agalactiae is a common mastitis agent whose eradication from individual herds is practical and cost effective. Most infected cows show few clinical signs of mastitis, such as abnormal milk, but usually have high somatic cell counts (SCC). A decrease in milk production almost always accompanies infection. Mastitis caused by *Strep. agalactiae* should be suspected in a herd if cow or bulk tank SCC's begin to rise and remain high, especially when bulk milk SCC is 1,000,000 cells/ml or higher. Occasionally high bacteria counts in bulk tank milk will occur when infected udders shed high numbers of *Strep. agalactiae* in the milk.

Streptococcus agalactiae primarily infects the cisterns and the ductal system of the mammary gland. An irritant is produced, causing inflammation of the gland which is mostly subclinical with occasional clinical symptoms. Accumulation of bacterial waste products intensifies the inflammatory response, resulting in destruction of milk producing tissue and reduced milk yield or agalactia. *Streptococcus agalactiae* rarely causes severe illness, but extensive scarring of a quarter may render it unproductive in subsequent lactations.

Staphylococcus aureus

Staphylococcus aureus is more difficult to eradicate than *Strep. agalactiae*, but definitely controllable. Infected udders are the most important source of infection. The organism readily colonizes teat skin lesions and the teat canal, and eventually passes into the mammary gland. The organism may also survive at other sites on the cow. Mastitis caused by *Staph. aureus* produces more damage to milk-producing tissues than *Strep. agalactiae*, and decreases milk production with reported losses of 45% per quarter and 15% per infected cow. Recurring signs of mild clinical mastitis often causes additional losses. High bacteria counts in bulk milk are generally not seen with *Staph. aureus* mastitis. However, as the number of infected cows increases, the bulk milk SCC increases, resulting in decreased milk quality. Herds with bulk tank milk SCC greater than 300,000 to 500,000 cells/ml often have a high prevalence of *Staph. aureus* infected quarters. The bacteria damage the duct system and establish deep-seated pockets of infection in the milk secreting tissues followed by abscess formation and walling-off of bacteria by scar tissue. This walling-off phenomenon is partially responsible for poor cure rates of *Staph. aureus* infections by antibiotic therapy. During the early stages of infection, damage is minimal and reversible. However, abscesses may release staphylococci to start the infection process in other areas of

the gland with further abscess formation and irreversible tissue damage. Occasionally, infection by *Staph. aureus* may result in peracute mastitis with gangrene. This gangrenous mastitis is characterized by a patchy blue discoloration and coldness of the affected tissue.

***Mycoplasma* species**

Mycoplasma spp. are highly contagious organisms, are less common than *Strep. agalactiae* and *Staph. aureus*, and are generally diagnosed in herds experiencing outbreaks of clinical mastitis that resist therapy. Frequently, the history of affected herds includes the recent introduction of new animals, a previous outbreak of respiratory disease, and/or cattle with swollen joints. Cows of all ages and at any stage of lactation are susceptible, but animals in early lactation seem to suffer more severely because of the occurrence of increased mammary gland edema. *Mycoplasma* spp. should be suspected in herds when multiple cows have clinical mastitis in more than one quarter but continue to eat and have little evidence of systemic disease. Cases are unresponsive to treatment, and generally affected cows show a marked drop in the milk production or cease lactating. However, *Mycoplasma* spp. may be isolated from high-producing cows in herds that do not experience the classic signs. Subclinical cases with intermittent signs of clinical mastitis are not uncommon. Infected cows may have a high SCC and shed organisms for variable periods. *Mycoplasma* spp. may damage the secretory tissue and produce fibrosis in the udder as well as abscesses with thick fibrous walls, and great enlargement of the supramammary lymph nodes.

Management Programs

Transmission of pathogens that cause contagious mastitis from infected cows to uninfected herdmates most generally occurs at milking time. Management factors important in transmitting contagious pathogens include the milking machine, milkers' hands, teat washing materials and treatment procedures. Spread of contagious pathogens can be greatly reduced by good udder hygiene and postmilking teat dipping.

Other management factors which may influence susceptibility to mastitis pathogens including those that cause contagious mastitis are:

Injury. Healthy teat skin is the first line of defense against mastitis. Lesions on teat skin frequently harbor bacteria that may cause mastitis. The cause of teat injuries should be quickly identified and eliminated. In cold climates, frostbite and chapped teat skin constitute injury and such injuries have been shown to harbor *Staph. aureus*.

Nutrition. Soils in many parts of the United States are deficient in selenium, and feedstuffs grown on these soils will be deficient. Also, the vitamin A and E content of ensiled forages decreases during storage. Research indicates that diets deficient in vitamins A, E or the trace minerals selenium and copper can lead to increased incidence of mastitis.

Milking system. Machine milking can also influence the rate of new contagious mastitis infection:

- a) The role of machines as a carrier of bacteria to uninfected cows can be minimized by segregating and milking cows with known infection or those with high SCC last.
- b) Bacteria can be transferred during milking from the infected quarter across the claw-piece to an uninfected quarter of the same cow. Cross infections may account for up to 40% of new infections in some herds. Properly designed and functioning milking equipment will prevent movement of air and milk droplets from one quarter to another, and may reduce these infections.
- c) Abrupt reduction in milking vacuum can cause movement of air toward the teat end, and droplets of milk may strike the teat end (impacts). If the droplets are contaminated with bacteria, the impact may force bacteria into the teat duct and may increase the rate of new infection. Research has shown that high new infection rates were associated with vacuum fluctuations only when accompanied by liner slip, a condition known to generate teat end impacts.

d) Although it has been difficult to show experimentally that the milking machine can damage the teat end sufficiently to increase the chance of infection, machine operators must always be aware of this possibility.

Control Procedures

Contagious organisms, for which the primary source is the mammary gland of the cow, are transferred primarily by events associated with milking. Good milking procedures, including cleaning and sanitizing teats before milking and postmilking teat dipping, help reduce the spread of infection from infected to uninfected cows. In mycoplasma infected herds, the use of rubber or plastic gloves when milking is recommended. Ideally, gloved hands should be disinfected between cows and dried off with paper towels. Some research trials have indicated additional control of contagious pathogens by automated disinfection of teat cup clusters (backflushing) or dipping teat clusters in disinfectant between cows. However, this practice in the field has minimal effect in reducing the rate of new infection, especially when compared to what can be achieved when an effective postmilking teat dip is used properly.

Streptococcus agalactiae

Streptococcus agalactiae is an obligate parasite of the mammary gland which means that, in nature, it can only live and reproduce in the gland. Because of this host-parasite relationship, *Strep. agalactiae* can be controlled and eradicated from a herd by identifying and treating infected animals. This can be done by obtaining milk samples for microbiological culture from all cows in the herd, and by treating the *Strep. agalactiae* infected udders with an appropriate intramammary infusion product. *Streptococcus agalactiae* infection responds well to beta-lactam intramammary mastitis preparations in both lactating and dry cows. Using other classes of antibiotics often results in poor cure rates. Some chronic infections do not recover. If two regimens of treatment do not eliminate the infection, culling should be considered to prevent infecting other cows.

Once *Strep. agalactiae* has been eliminated from a herd, careful control measures should be maintained to prevent reinfection, including monitoring bulk tank milk by monthly cultures for at least 6 months to assure clearance of infections. A closed herd is required to maintain it free from this pathogen. Breakdowns frequently happen due to the purchase of infected animals or by using contaminated milking equipment at fairs or livestock shows. New arrivals should be sampled before joining the milking herd. Dry cows and heifers also need to be included in *Strep. agalactiae* eradication programs, since they can represent a source of re-introduction of the organism to the milking herd. Calves fed discarded milk containing *Strep. agalactiae* can spread the infection by suckling themselves or other penmates. Once *Strep. agalactiae* is established within the immature gland, it can persist until first parturition many months later. Therefore, dry cows and heifers should be cultured at calving before joining the milking herd.

Staphylococcus aureus

Staphylococcus aureus commonly produces long-lasting infections that can persist through the lactation and into subsequent lactations. To prevent *Staph. aureus* intramammary infections, it is necessary to limit the spread of this organism from cow to cow and to reduce to a minimum the number of infected cows in a herd. To attain these objectives, milk from infected cows should never come in contact with uninfected cows. *Staphylococcus aureus* infected cows should be identified and milked last, or milked with a separate unit from those used on uninfected cows. Clinical mastitis sometimes occurs following prolonged subclinical infections. Antibiotic therapy during lactation may improve the clinical condition but usually does not eliminate infection. Infected quarters which do not respond to a single regimen of therapy are generally unresponsive to additional lactation treatment, regardless of culture and antimicrobial sensitivity tests. Dry cow therapy may give better results than treatment during lactation, but even then, chronic infections can persist into subsequent lactations. *Staphylococcus aureus* infection status of cows should be one of the considerations when culling decisions are made.

Maintaining a *Staph. aureus*-free herd is possible but more difficult than maintaining a *Strep. agalactiae*-free herd, and *Staph. aureus* may reappear even in a closed herd. To achieve a "*Staph. aureus*-free" status, every infected cow must be identified and handled as described in the preceding paragraph. The "uninfected" herd should be closely monitored by individual SCC and milk culturing. Teat injuries and chapped teat skin during cold weather should be minimized because they predispose cows to *Staph. aureus* intramammary infections.

Staphylococcus aureus has also been implicated in intramammary infections in calves, breeding age heifers, and heifers at calving. The source of the *Staph. aureus* to infect these young animals is not known but may be contaminated bedding, feeding milk from *Staph. aureus* infected cows, cross suckling, or exposure to high fly populations. Pregnant heifers should not be housed together with dry cows, when a significant number of cows in the herd are known to be infected with *Staph. aureus*.

***Mycoplasma* species**

There is no effective treatment for mycoplasmal mastitis, but the disease can be controlled by identifying infected animals by sampling and culturing milk samples from all cows in the herd, followed by segregation and/or culling the infected animals. If *Mycoplasma* spp. infected cows remain in the herd, they should be milked last or with a separate unit from those used on uninfected cows. Improper intramammary treatment of lactating or dry cows for other mastitis pathogens provides a good opportunity for spreading mycoplasmal infection from cow to cow, and even from herd to herd. Rigid sanitary precautions must be followed including the use of only single-use commercial treatment products. Multidose vials and intramammary infusion products have been implicated in herd outbreaks of mycoplasmal mastitis.

Great care should be used when purchasing replacements. Many herds become newly infected by adding cows with *Mycoplasma* spp. infected udders. Before commingling with the herd, milk should be cultured from all replacement cows and heifers at calving for *Mycoplasma* spp. as well as for *Strep. agalactiae* and *Staph. aureus*. When herds are purchased, it is a good policy to culture all suspected mastitic cows as well as bulk tank milk.

Sometimes, the disease may suddenly appear in previously uninfected herds without the introduction of replacements. *Mycoplasma* is widely found as a resident of the bovine respiratory tract of apparently normal cows, and transfer of the microorganisms from the lungs to the mammary gland can occur. Mycoplasmal mastitis outbreaks have been associated with respiratory problems in calves, heifers, and cows in poorly ventilated barns. Young calves fed milk from cows with *Mycoplasma* spp. infected mammary glands are prone to have respiratory infections, which may persist for several months.

A herd suspected of having mycoplasmal mastitis, based on history and clinical signs, should be cultured in order to establish the nature of the infection. Mycoplasmal infections may be complicated by common bacterial infections which occur concurrently.

Summary - Controlling Contagious Mastitis

- 1. Prepare teats properly prior to milking.** Udders should be dry, and teats should be cleaned and dried prior to machine attachment using single-service paper towels or individual cloth towels which have been laundered and dried after each milking.
- 2. Use adequately sized, properly functioning milking equipment.** Use milking machines in a proper manner on properly prepared cows. Avoid unnecessary air admission into the teat cups during unit attachment, machine stripping and unit take-off that can cause irregular vacuum fluctuations.
- 3. Disinfect teats.** Use an effective product after every milking. Postmilking teat disinfection is the *single most effective practice* to reduce the rate of new intramammary infection by contagious pathogens.

4. Assess clinical cases for treatment decisions. Most cases of clinical mastitis other than those caused by *Strep. agalactiae*, are only minimally affected by antibiotic therapy during lactation. Work together with the herd veterinarian to design a management protocol for mild, moderate, and severe cases of clinical mastitis.

5. Use dry cow therapy. Treat each quarter of every cow at drying off with a single dose of a commercially formulated, FDA-approved dry cow treatment product.

6. Consider culling chronically infected cows. Cows which are infected with *Strep. agalactiae*, *Staph. aureus*, or *Mycoplasma* spp. present a risk to noninfected cows in the herd.

7. Maintain a closed herd. If new animals are purchased, culture milk from them before adding them to the herd.

8. Establish an active milk quality program with the herd veterinarian. Achievable goals for controlling contagious mastitis include: 0% cows infected with *Strep. agalactiae* and *Mycoplasma* spp.; and less than 5% of cows infected with *Staph. aureus*.