MILK QUALITY PROGRAMS FOR TRANSITION COWS AND HEIFERS

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TAKE HOME POINTS:

- Mastitis in transition cows and heifers can be a major contributor to herd mastitis problems!
- The early dry period and last few weeks before calving are high-risk mastitis periods!
- A mastitis surveillance program based on SCC/ culture must be in place early postpartum!
- Prevention and treatment strategies must be organism based so cultures are critical!
- Prevention should focus on controlling or minimizing organism exposure, optimizing teat end health, and maximizing animal immunity.
- Treatment is after the fact, but when needed, should be carefully strategized based on organisms involved using proper therapy, treatment procedures and protocols, and veterinary input.

Great progress has been made over the past decade to lower somatic cell counts and improve udder health. This has enhanced farm profitability while also assuring safe, wholesome, consistently high quality dairy products for consumers. Improved surveillance coupled with proper milking procedures and equipment have lowered and minimized contagious mastitis such as *Strep. agalactiae* and *Staph. aureus (and Mycoplasma)* in many herds. Concurrently, many herds have seen an increase in environmental and clinical mastitis as evidenced by treatment records and clinical mastitis observations. Many herds have also seen mastitis in transition cows and heifers become a major contributor to their mastitis and milk quality problems. **The objectives of this paper are to discuss: 1) the importance of mastitis in transition cows and heifers; 2) why the risks for mastitis are high in these animals particularly prior to calving; 3) diagnostic tools for early surveillance and identification; 4) systematic prevention strategies; and 5) therapy strategies for both clinical and subclinical mastitis.**

How much mastitis is in transition cows and heifers and what is it costing you?

Most often, attention is directed towards clinical mastitis since it can be easily visualized. Often little clinical mastitis is seen prior to calving. A high percentage of clinical mastitis during the first week postcalving is a result of infections that were in the gland prior to calving. Studies have shown **clinical mastitis rates** in fresh animals from **2- 45%**. Recent summer herd investigations by the author on high producing dairies showed 10-75%. Animals with clinical mastitis early postcalving have **higher risks for culling, developing a non-functional quarter, and decreased milk production. Economic losses due to pre-partum infections in heifers are higher than mature cows due to the damage done to the rapidly growing mammary tissue.**

Subclinical infections account for the largest contributor to heifer mastitis problems and losses. Most studies show that **>70% of heifers and 40% of quarters are infected prior to calving** and approximately **30-50% of cows and heifers and >20% of quarters infected at calving**. With heifers, these infections can be contracted from as early as 1 week after birth until first calving, depending on the organism involved, while cows are at highest risk in the early and late dry period. Recent therapy studies directed at a certain group of subclinical infections in heifers resulted in > 1000 pounds increased milk production.

Early dry period and last 2 weeks prepartum: A RISKY business!

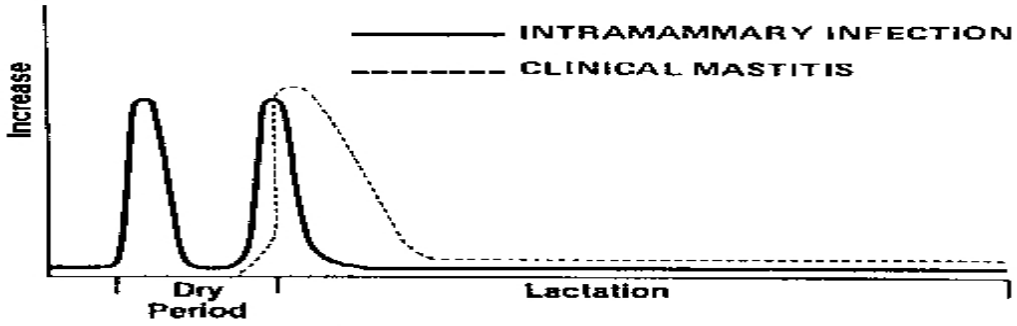

Figure 1. Incidence of new infections during the dry and lactation periods.

It has been well known for over 3 decades that there are increased risks and higher incidence of mastitis and susceptibility during the first 10 days and last 2 weeks of the dry period, with most of the clinical mastitis postpartum resulting from this (Figure 1). The practice of dry cow therapy has been able to prevent some early dry period infections, but only recently have targeted strategies been developed for preventing prepartum problems. Major reasons for this increased susceptibility include: a) milk is accumulating in higher quantities, thus leading to teat and udder distension, teat shortening, and potential leakage (easier bacterial penetration); b) milk is very high in solids, not being flushed out, and is high temperature (~ 101^0F) so it serves as a great incubator; and c) although somatic cell (local immunity) levels are high, they are pre-occupied eating the milk components and not very efficient at killing bacteria. Coupled to this prior to calving are nutritional, environmental, hormonal, and social changes and stressors which result in immune suppression to the whole animal's body (not just mammary gland). That's why minimizing germ load is crucial!

Teat closure?

During the middle of the dry period there are lower risks for infection. This is mainly due to gland secretions (no milk) that have enhanced immune factors, and more importantly, the presence of a keratin plug in the teat end that provides both a physical and chemical barrier. Recent work from both New Zealand and North American (Canada, NY,KS and IA) have shown that a certain percentage of teats never close and remain open during the whole dry period (Figure 2). Approximately 50% of teats are still open at 1 week post dry off and between 10-25% of teats remain open for the entire dry period. This represents a heightened risk for mastitis as > 90% of infections occurred in open quarters in the New Zealand study.

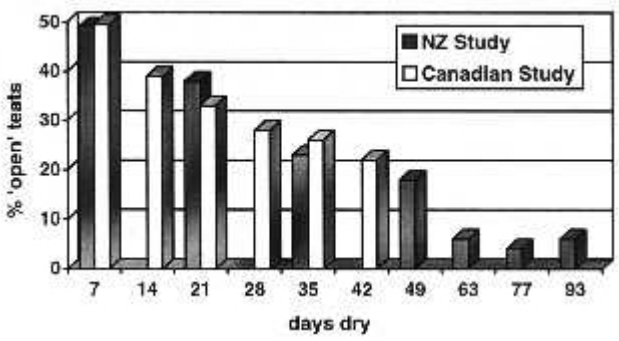

Figure 2. Percentage of teats that remained open during the dry period in 2 studies.

The percentage of teats that remain open during the dry period is highly variable between herds as evidenced by the North American study (Figure 3). Although 4 herds showed between 10-25% teats remaining open for the dry period, one herd had 64% of teats that remained open.

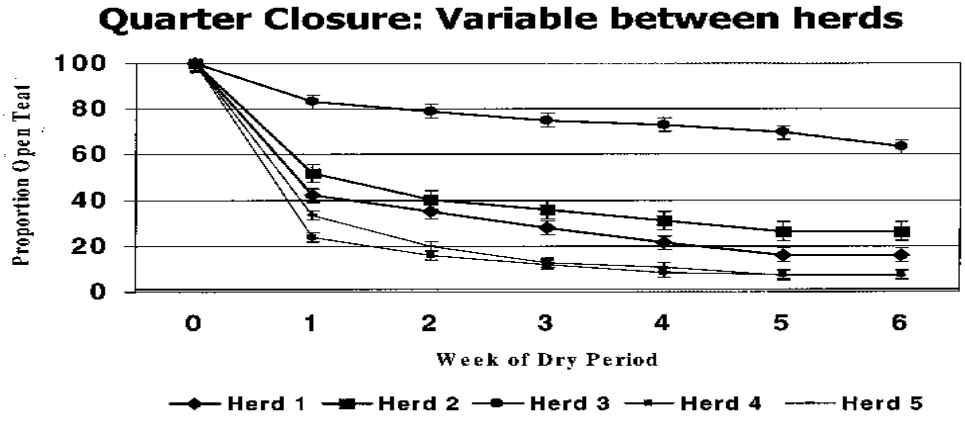

Figure 3. Percentage of teats remaining open during dry period in 5 herds (North America).

The percentage of teats that remained open was also influenced by milk production of the animals at dry off (Figure 4). Cows producing >21 kg milk at dry off were 1.8 times more likely to have teats that failed to close during the dry period.

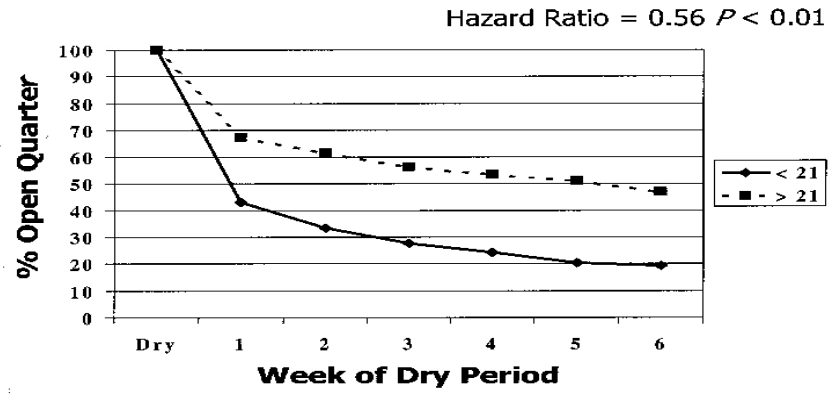

Figure 4. Percentage of teats remaining open during the dry period in 5 herds (North America) as a function of milk production.

Data from New Zealand substantiates that over **20% of heifers' teats are also open prior to calving**. Because of this high percentage of quarters that fail to close and/or are open at calving, strategies to minimize bacterial load and potentiate closure (naturally or artificially), as well as maintain or enhance teat tissue integrity are critical.

Although rates of mastitis will differ across herds due to management and control strategies, mastitis resulting from dry cows and heifers till accounts for major economic losses in many herds. Implementing an active surveillance and diagnostic plan and understanding the causative organisms are the first steps to controlling this disease.

Diagnosis of Mastitis

Clinical mastitis:

Clinical mastitis is defined as the production of abnormal milk with or without the occurrence of secondary symptoms such as swollen quarters or an elevated body temperature and / or other systemic signs. Although mastitis in most animals is rarely apparent prior to calving, routine observations for abnormal swelling is important. Normal udder secretions prior to calving range from a honey like appearance to normal milk. Clinical mastitis can be recognized in pre and post calving secretions, colostrum or milk by the occurrence of gargot, abnormal texture or discoloration.. **It is extremely important to obtain an aseptic milk sample from all clinical mastitis quarters (prior to any potential therapy) for bacterial identification. An achievable goal should be < 5% of animals freshening with clinical mastitis.**

Subclinical mastitis

Somatic cell counts (SCC)

Subclinical mastitis is more difficult to detect because the milk appears normal but the SCC is elevated and bacteria may be present in the milk. There is no absolute threshold of SCC that defines the occurrence of subclinical mastitis but it is highly likely that an animal with a SCC of >200,000 cells per ml post calving has mastitis. It is important to recognize that SCC values obtained from DHI tests are from milk that is co-mingled from all four quarters. Single quarter infections may not be apparent until SCC value of the infected quarter is very high. **An achievable goal is < 10% of animals with linear score 4 or 200,000 SCC at first test post calving**.**

Although evaluating SCC on first test date can give indications of mastitis problems in fresh cows and heifers, it can not delineate whether problems occur pre or post calving, so it is imperative to <u>incorporate an evaluation tool as early postpartum as possible</u>!

California Mastitis Test

An indirect test such as the California Mastitis Test (CMT) can be used postpartum to identify quarters that are likely to be and/ or have been infected. Approximately **55-80% of major mastitis infections will be CMT+ during the first week postpartum.** All quarters with CMT reactions of trace or greater should be suspected of subclinical mastitis. However, The CMT should be interpreted cautiously because although the slightest amount of thickening indicates the presence of a high SCC, **only about 20-40% of CMT+ reactions are associated with culturable major mastitis pathogens,** while many infections have been cured but SCC has not declined to baseline values. **Treatment based solely on CMT results (especially without knowledge of predominant mastitis organisms in the herd) will result in many uninfected quarters being treated**. Negative predictive values or the ***likelihood that a negative CMT is associated with an uninfected quarter is greater than 90%. Therefore the most accurate use for the CMT test is to confirm negative quarters, as well as to confirm that mastitis control programs are working.*** When higher percentages of CMT+ quarters and animals are seen, owners and managers should culture CMT+ quarters to determine causative organisms, and use this to assess weaknesses in prevention.

***** <u>You can't interpret a CMT if you don't run the test!</u> The most important step is to run the CMT test and then to interpret it properly.** Most producers shy away from running CMT because they assume it is time consuming and all cows have high SCC the first week post calving. These are myths! The CMT is simple and easy to run, takes about 1 min, and costs pennies. In a well managed dairy with excellent mastitis control, **< 10% of cows and 5% of quarters should be CMT positive (and will be : – Prove it to yourself!!).**

Bacterial isolation and identification

Microbiologic exam of milk samples obtained from suspect quarters or clinical mastitis is a standard diagnostic procedure. It is extremely important that samples obtained for culture, especially during the precalving period, are obtained under the strictest hygienic conditions so infections aren't inadvertently introduced during the sample collection process. Teats should be thoroughly cleaned (teat dipped and dried), then disinfected with alcohol swabs prior to collecting a milk sample into a sterile container. Samples should be refrigerated immediately or frozen. Differences in sample collection technique, in shedding patterns of bacteria and in laboratory procedures make the interpretation of microbiologic results imprecise. The isolation of mastitis causing bacteria from milk samples or secretions obtained from the udder prior to calving is highly suggestive that a quarter is infected with mastitis. However, the lack of bacterial growth from a single composite or quarter milk sample is not always diagnostically useful.

The most important point is to have an early postpartum plan to identify mastitis. Define your goals (% clinicals, high SCC, CMT+, identify all contagious mastitis, etc.). Then select the appropriate tool(s) that facilitate this.

<u>Primary mastitis organisms: KNOW THE GERMS!</u>

Causes of mastitis are 99% bacterial so practice germ warfare: **ie. know the germs!** Knowing the causative organisms tells you everything (where it is, how it lives, how and when it gets into an udder) and thus becomes the basis for both prevention and therapy strategies. Organisms found in transition cows and heifers can be grouped by contagious, environmental, and normal skin flora based on their source and their potential to be spread between animals.

Contagious organisms:

Staphylococcus aureus

- Lives primarily in udders of infected cows, but can be found on many body sites of heifers, especially when there is a problem in the milking herd.
- Very aggressive, invasive organism.
- Often associated with factors that induce teat trauma and cracking such as aggressive suckling by cohorts; flies; sharp grasses, thistles, and pastures; and edema and harsh weather conditions (mud, wind chills) pre calving.
- Can enter the mammary gland anytime after birth in heifers and persist until first calving.
- Can scar the tissue permanently and form abscesses.

Mycoplasma bovis

- Common inhabitant in the respiratory tract. Can get to mammary gland through circulation (blood) when animal is stressed (often calving time, especially in heifers!)
- Can easily be spread from infected animals to uninfected animals post calving because of their reduced immunity.
- Feeding of waste milk from infected cows is a primary route of infection for calves. Contact with organisms from other animals through air transmission is a secondary route.

Environmental organisms

Environmental streptococci

- Highest risks during the early dry period (cows) and last 2 weeks pre calving (cows and heifers).
- Associated with clinical mastitis post calving but can be subclinical.
- Associated with bedding that is moist and contaminated (*Strep uberis).*
- Easily colonizes teat skin; does not need a lot of moisture to grow or colonize.
- Sometimes associated with teat trauma (*Strep. dysgalactiae).*

Coliforms (E.coli, Klebsiella)

- Highest risks during the last 2 weeks pre calving
- Associated with clinical mastitis post calving, sometimes with severe systemic signs, but can be subclinical.
- Associated with moisture, mud and manure in the heifers housing environment.
- Does not colonize teat skin very well. Gains entry to the gland via liquid so controlling moisture at the teat surface is critical.

Normal Skin Flora Organisms

Coagulase negative staphylococci

- Found as part of the normal skin flora
- Accounts for > 80% of all mammary infections in heifers (also in cows in well managed herds!)
- Usually associated with subclinical mastitis, but can result in clinical mastitis.
- Usually associated with very mild SCC elevations, thus making it hard to detect by SCC or CMT, and thus usually considered not important as a mammary pathogen
- The potential to lower legal SCC limits to 400,000 coupled with therapy research showing an 1100 pound milk production increase when this is eliminated from heifers at calving has increased interests in this organism.

Udder Edema and Mastitis

Most risk factors that contribute to the development of mastitis are related to exposure to mastitis causing organisms. One exception to this is the occurrence of udder edema. Udder edema occurs primarily in heifers and is a well-recognized risk factor for mastitis. A combination of genetics, diet and housing generally contribute to the development of udder edema in heifers. When udder edema occurs, the circulation of blood and lymph fluid through the udder is impaired and the function of the milk secreting cells is disrupted. By impairing the circulation, the teat is more prone to weather

damage and dehydration, especially during winter or dry, hot times. Also, udder conformation is impaired, usually leaving teats shortened, and much harder for proper unit and inflation positioning and proper teat massage during milking. Mastitis is a common consequence of this scenario.

Mastitis Control

The primary focus of mastitis control should be on prevention. Prevention of problems minimizes or eliminated the needs for therapeutic controls. If needed, treatment or therapy strategies should be discussed and implemented with the herd veterinarian based on proper organism diagnosis and sound monitoring and residue prevention programs.

Prevention of Mastitis

Mastitis occurs when mastitis pathogens succeed in defeating the animal's immune response. Prevention of mastitis in heifers is based upon ***reducing exposure to mastitis pathogens, maintaining the health and integrity of the teat as the primary and first defense mechanism, and maintaining and / or enhancing the ability of the heifers' immune system to respond.***

Controlling Organism Exposure

- **Control the prevalence of mastitis in the existing adult herd** - Exposure to contagious mastitis is more likely to occur when many animals are infected as compared to herds with few animals infected.
- The key to reducing environmental mastitis organism exposure is through **proper housing and sanitation, especially the last two weeks prior to calving.** House animals in an **adequately bedded area** that **is clean and dry** and provides **sufficient space** for all animals Environmental mastitis pathogens such as *E. coli*, and the environmental *Streptococci spp.* live primarily in bedding, moisture, mud and manure. Avoid overcrowding at this time as it not only leads to increased exposure to organisms, but may dampen the immune system due to nutritional and housing (cow comfort) competition.
- Consider using **persistent teat dip external sealants or internal plug sealants during the dry period (last week prior to calving for heifers). Dips** can be applied once at dry off, but then must be dipped to provide continuous protection the last week prior to calving. This may mean dipping at 3-3.5 day intervals, and proper housing to restrain animals for dipping is critical. **Costs for 3 dippings (1X at dry off, 2X prior to calving) will be about $3 product cost plus labor. Internal sealants** (Orbeseal, Pfizer, Inc) can be put in at dry off and remained protective for the whole dry period until stripped out at calving. **Costs are about $7-8/animal.** Studies on both these technologies can result in **> 60% reduction in environmental mastitis infections when done properly. Proper teat sanitation prior to administration of either technology is critical.**
- **DO NOT use fresh pens to house sick cows!** The use of fresh pens to house sick cattle can result in contamination of the bedding with secretions (milk, blood, feces etc.) from sick animals. These secretions may remain infectious for variable periods of time (depending upon the characteristics of the organism, the type of bedding and the environmental conditions) and serve as a point of exposure.

- **Milk fresh heifers first!** Milking fresh heifers with milking machines that have been used previously on cows that are shedding contagious mastitis organisms is a common route of exposure. Care should be exercised to assure fresh heifers are Mycoplasma negative.
- **Feed milk replacer or milk from healthy uninfected cows** rather than waste milk. If waste milk is to be fed, consider pasteurization. This must be done with proper equipment and techniques (time, temperature, etc).
- **The use of individual stalls for preweaned calves.** Co-mingling of preweaned calves is a risk factor for the development of contagious mastitis in heifers. Preweaned heifers that are grouped together may suckle on teats of other calves and transfer mastitis causing bacteria.

Maintaining Teat Health and Integrity

- **Control factors that dehydrate the teat skin and lead to cracking!** Mud at any time can dry the teat surface and increase risks for dehydration and cracking both the teat skin and teat end. Exposure to cold weather and wind chills and/or dry hot weather, especially when animals are bagging up prior to calving, can also enhance teat skin cracking.
- **Control excess edema!** Edema accentuates machine and weather issues that can dehydrate and crack the teat skin and end.
- **Control flies!!** – especially important in the control of *Staph aureus*. Several studies have demonstrated that biting flies can play a role in the transmission of *Staph aureus* between infected and uninfected animals. It is thought that flies congregating on teat ends of infected cows can become contaminated with bacteria present in milk droplets and mechanically transfer the bacteria when they land on the teats of uninfected animals. More importantly, biting flies cause a great deal of trauma to teat skin and ends thus making the gland more prone to S. aureus from heifer body sites.
- **Culling of calves, heifers, and animals that persist in suckling other females**. In addition to potentially spreading contagious pathogens with young calves, the aggressive nature of suckling animals almost always leads to teat trauma and increased mastitis risk.
- **Control growth and height of sharp grasses, thistles, etc.** and decrease exposure of heifers to these areas that risk teat trauma as a result of sharp, cutting plant materials.

Maintaining / Enhancing the Immune System

- **Feed a well-balanced diet that enhances the animal's immune systems.** The immune system is an army that relies on proper nutrition and nutrients to keep it healthy, strong, and mobile (get troops to battle zones where they are needed). Having all the nutrients from major ones (energy, protein, fat, fiber, and water) to micro ones (minerals and vitamins) are critical.
- **Optimize conditions to maximize dry matter intake pre calving.** Avoid overcrowding. Keep feedstuffs and rations fresh, and avoid unpalatable ingredients that depress intake. Avoid slug feeding of grains, or TMR conditions that may lead to sorting. These can increase risks of acidosis, off- feed issues, and ketosis. This is especially critical the last week before calving and first few days post calving when dry matter intake is innately depressed in these animals.
- **Vaccination:** Consider boosting immunity by using mastitis vaccines where appropriate. It is imperative to remember that vaccines are no substitute for good management and can't

overcome overwhelming organism exposure. Also, vaccines are designed to enhance the ability (speed and strength) of the immune system, but this will only happen correctly if the animal (immune system) has the appropriate nutrients to work with.

- ***Staph. aureus vaccines:***
  - Most research and field evidence shows **limited benefits in reducing infections.**
  - Variable benefits in decreasing severity and duration of infection
  - **Strategy should only be considered when the milking herd has a problem and heifers are at increased risks to S. aureus organisms.**
  - When implemented, it must be done properly which usually encompasses 2 initial shots spaced 2 weeks apart at 6 months of age, followed by boosters at least every 6 months until after calving.
  - **Most attention should be placed on reducing the contagious mastitis in the milking string and limiting exposure to young calves.**
- ***Core antigen vaccines:***
  - **Reduce the severity of infections caused by gram negative bacteria (especially coliforms) such as E. coli and Klebsiella.**
  - Vaccine **cross protects against many gram negative organisms** (doesn't need to be species or strain specific)
  - Potential for about **100 days of protection or help pre-post calving** if done properly.
  - **May have benefit in uterine, gut, and respiratory infections as well as the mammary gland, and may also provide some benefits to the calves.**
  - Proper administration and timing is critical.

- ***Mycoplasma vaccines:*** **No controlled studies so not recommended!**

<u>Therapy / Treatment of Mastitis</u>

Having to apply treatment or therapy may be necessary in some situations, but realizing that economic losses have already occurred and using the information to prevent future cases is imperative. No treatment or therapy should be instituted when the risks outweigh the potential benefits. Critical elements essential to successful therapy which results in maximum economic benefits (maximize cure rates and minimizing residue and animal risks) are as follows:

- **Active surveillance program to diagnose problems early, especially clinical mastitis.** Early detection and action is critical for therapeutic success.
- **Therapy must be organism based!** Different organisms require different therapy strategies. Aseptic quarter milk samples should always be obtained prior to treatment to define causes.
- **Records and systems to monitor success must be in place!**
- ***Monitoring <u>infection cure rates</u>:*** Clinical cure can be accomplished through visual appraisal of the milk, but must be coupled with **somatic cell counts (electronic or CMT) and/or culture** to assure bacteriological cure.
- ***Monitoring <u>residue prevention</u>:*** An **active, on farm antibiotic residue testing program** should be in place. It is critical to know and understand the antibiotics and therapies being used (including **withdrawal times for milk and meat**), and run **appropriate tests for that specific antibiotic/product.**
- **Work closely with your veterinarian in all aspects of therapy decisions and monitoring!**

Although some therapy may be administered systemically, most strategies involve intramammary treatment. In addition to the above key elements, proper animal side practices are critical when approaching treatment, especially intramammary, to minimize animal risks.

- **Teat cleanliness (sterility) before inserting anything!** The risks of inserting an organism worse than the current problem is high if practices are not followed to minimize existing bacteria on the teat. Teats should be dipped in an effective teat dip and dried thoroughly. Teats should then be wiped or scrubbed with an alcohol pad.
- **Collect an aseptic milk sample for culture before any treatment!** Once teat is prepped / cleaned, discard the first few strips of milk then collect a sample for culture.
  Use partial insertion technique for antibiotic tubes or any type of teat cannula. The greater the penetration into the teat canal, the greater the risk of damage and contamination. Most commercial tubes are now manufactured with a short tip option.
- **Use ONLY APPROVED PRODUCTS and/or products under the guidance of your veterinarian.** The inside of the mammary gland is sensitive. Infusion of unapproved products and "natural products" often leads to increased irritation due to their foreign nature, and also constitutes an adulterant.
- **Consider dipping the treated teat(s) with a persistent barrier teat sealant dip to provide protection .**

Clinical and Subclinical Mastitis

All clinical and subclinical mastitis, whether pre or post calving, should be evaluated and treated accordingly based on the organism involved with the above recommendations and principles. It is imperative to know the organism since this will dictate whether to treat or not, and what the potential success is for therapy.

Staph. Aureus Mastitis (animals and herds at risk)

Staph aureus is an invasive organism that can infect heifer mammary gland early and persist to calving, causing massive damage and milk loss, or be picked up by cows during the dry period especially if teat trauma occurs. Consideration should be given to early postpartum, aggressive, extended intramammary antibiotic therapy for cows and heifers that calve with S. aureus. This is not designed for chronic cows.

Herds with a **Staph aureus problem** should **consider administering a non-lactating or dry cow intramammary antibiotic to <u>heifers.</u>**

- **Cure rates of > 90% for Staph. aureus** have been achieved **in heifers**.
- Cured heifers **reduce risk of spread** and showed a **10% milk production increase**.
- **Administer a single tube/quarter of an approved non-lactating or dry cow intramammary antibiotic** following the proper teat preparations and recommendations.
- **Administer > 45 days before expected calving.** Treatments in all trimesters of pregnancy are equally effective. Timing of treatment is best determined by convenience for the herd. Timing closer to calving can assure cure with less chance of re-infection. To minimize risk of extended residues / milk discard, therapy should be given >45 days before expected calving if possible.
- **Monitor residues post calving and assure milk is negative before bulk tank entry.**
- **This is for potential Staph aureus herds only where the benefits outweigh the risks.**

Subclinical Mastitis Due to Coagulase Negative Staph. (CNS) (Heifers only!)

Approximately 50% of heifers and 30% of quarters are infected with CNS at calving, even in well managed herds. CNS infections are usually subclinical with only mild SCC elevations (many undetectable by even CMT). However some recent studies, where a single lactating cow intramammary product was administered prepartum resulted in high cure rates and a >1000 pound milk production increase in Jersey heifers. These results have prompted great interest in this area.

- **Cure rates > 90% for CNS; > 1000 pound potential milk production increase.**
- **Should ONLY be considered in well managed herds where other mastitis risks and organisms are controlled!!** This will not be economically beneficial in Staph aureus herds. This will also be **economically catastrophic in herds with poor environmental mastitis management prepartum**. Poor environmental management would not only increase risks of infusing germs during the process, but the high cure rate will leave more glands susceptible to other more potentially harmful environmental organism.
- **Administer a single tube/quarter of an approved lactating cow intramammary antibiotic 10-14 days prepartum** following the proper teat preparations and recommendations. This will accomplish maximum cure rates while minimizing extended residue risks and milk discard post calving.
- **Monitor residues post calving and assure milk is negative before bulk tank entry.**
- **THIS IS ONLY FOR WELL-MANAGED, LOW MASTITIS RISK HERDS!**

Summary

The profitable production of high quality milk is the ultimate goal of most mastitis management programs. With enhanced control programs in place over the last few decades to control mastitis during lactation, **heifers and dry/transition cows have become a major source of herd mastitis and milk quality problems.** Replacement heifers are critical to herd productivity as they represent the future milking and breeding stock for all dairy operations. Since the greatest development of milk producing tissue takes place during the first pregnancy, it is imperative to have a thorough mastitis management program in place for heifers to ensure maximum lifetime milk production and quality. A successful control program hinges on an active awareness and monitoring program coupled to an identification and knowledge of causative organisms. Prevention strategies focused at lowering organism exposure, maintaining teat health and integrity, and maximizing heifer immunity are crucial. Treatment and therapy strategies may be necessary at times, but should only be implemented where benefits outweigh risks, and should really serve as a reminder to evaluate and assess prevention strategies