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Mastitis Control Program

for

Staph. aureus Infected Dairy Cows

by

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Staphylococcus is a general name for a class of small, round bacteria capable of causing mastitis (inflammation of the udder) in dairy cows. There are a number of primary species of *staphylococci.* Among these is *Staphylococcus aureus, also* referred to as *Staph. aureus or* "staph." *Staph. aureus* is a major cause of chronic or recurring clinical mastitis in dairy cows. Other species of *staphylococci* can be isolated from the cows mammary gland, but their role is economically secondary to that of *Staph. aureus*.

This bulletin will focus on the sources of *Staph. aureus* infections within a dairy herd and will suggest control and prevention tips for the dairy farmer.

Where can *Staph. aureus* be found on the farm?

Staph. aureus infected cows are the main source of infection for other cows in the herd. *Staph. aureus* infected purchased heifers and chronically infected cows are a major source of new staph infections within a herd. Heifers with persistently colonized body sites (udder and teat skin, muzzle, and vagina) represent the primary reservoir of *Staph. aureus* for other heifers.

Other important sources of *Staph. aureus* are teat skin, teat sores resulting from mammalitis (viral infections) or pseudocowpox infections and milkers' hands. Chemical irritation, chapping, frostbite, fly bites, milking machine irritation or damage and other physical damage to teats greatly increase the probability that staph infections will develop.

How do *Staph. aureus* infections move from cow to cow?

Staph infections are usually transferred from infected cows to noninfected cows during milking via contaminated teat cup liners, milkers' hands, and common wash towels or rags. Flies have also been implicated in the transfer of *Staph. aureus* from one animal to another.

What kind of mastitis problems can *Staph. aureus* cause?

Because of its toxin (poison) production, *Staph. aureus* can cause mastitis problems ranging from non-clinical infections to clinical or gangrenous infections that may kill the cow. Once *Staph. aureus* gets into the mammary gland, it will invade deep into secretory cells and ductal tissue. Staph infections produce scar tissue and can cause small abscesses in the udder. The small abscesses can break open at anytime causing a re-appearance of clinical signs or elevated somatic cell counts. Scar tissue and micro-abscesses may permanently limit an infected quarter's ability to produce milk and to respond to treatment efforts.

How widespread can a *Staph. aureus* infections be within a herd?

It is not unusual to find dairy herds in which 40 to 50 percent or more of lactating cows have two or more quarters infected with *Staph. aureus.* Cows that have been infected at least once have a greater probability of becoming reinfected. In addition, the probability that a cow may become infected with *Staph. aureus* increases with age and increasing days in milk.

What signs might tip me off that a *Staph. aureus* problem is present in my herd?

These clues can indicate that a problem exists:

- Several cows in the herd have chronic clinical (but not life-threatening) mastitis with a response rate of less than 25% to lactating cow therapy.
- Clinical cases caused by *Staph. aureus* can occur in any age cow including prepartum heifers and at any time during lactation. Infected quarters will "flare up" or become clinical at regular intervals (about every two weeks to one month). Milk produced from infected quarters will be off-colored and will contain flakes and clots. Most infected cows will not run a fever. Some quarters will show mild to moderate swelling.
- Dry cow treatment efficacy will be less than 50% of existing infections. A majority of infected quarters at dry off will remain infected into the next lactation.
- Quarters dry up during lactation without any clinical signs.
- Percent of cows infected significantly increases with age and days in milk.
- Bulk tank somatic cell counts or DHI weighted somatic cell counts may range from 300,000 to 800,000 during the year with no seasonal variation except a possible increase following extremely cold weather.
- A significant number of cows will have DHI SCC greater than 500,000 (L.S. >5) over several test periods with no clinical mastitis.
- Usually, less than 20 percent of *Staph. aureus*-infected cows within a dairy herd will have a SCC greater than 1,500,000. A dairy herd that contains the same percentage of *Streptococcus agalactiae*-infected cows, for example, will generally

show much greater bulk tank somatic cell counts and individual cows will have much greater SCC.

- Pockets of scar tissue in infected quarters can be detected by palpating (feeling deeply into) a “milked-out” quarter or during the dry period.
- An increase in the herd SCC or clinical cases following an outbreak of mammalitis, warts or pseudocowpox that is associated with the onset of cold weather. Frost-bitten teats or severely chapped teats will also have a greater risk for *Staph. aureus* infections.
- An increase in the rate of chronic clinical mastitis within the herd following the purchase of lactating cows or heifers.
- Appearance of gangrenous mastitis in fresh first-lactation cows, especially during colder weather.

What should I do if one or more of the situations described above applies to my herd?

First, confirm the existence of *Staph. aureus* infections in your herd by screening high risk cows. Aseptically collect milk samples from 15 percent of your herd (or at least 10 to 20 lactating cows selected at random), or from a minimum of 20 cows with somatic cell counts of 400,000 or higher (DHI linear score of 5). Have the samples cultured by a qualified microbiological laboratory. Your veterinarian may have the proper laboratory facilities, or you can submit samples to your state animal health diagnostic laboratory or

your milk cooperative. Costs for the cultures may range from $5 to $10 per culture, depending on the organism responsible for the infection and the laboratory involved.

What kind of results from the culture tests would indicate a problem?

Staph. aureus from 50 percent or more of the cultured milk samples would indicate a **significant** problem within your herd. However, your herd has been exhibiting the classical symptoms of *Staph. aureus* infections, but less than 30% of milk samples submitted for culturing were positive for *Staph. aureus*. In this situation the cows that produced negative cultures but continue to exceed the 400,000 SCC should be retested for *Staph. aureus* within 2 to 4 weeks. The resampling is necessary due to the periodic shedding of *Staph. aureus* by infected cows. In addition, new infections based on a DHI SCC LS of 4 or greater (greater than 200,000)or other somatic cell counting systems should be cultured each month until a clear pattern of the causative organism is determined.

Your initial sampling could include all cows that have a DHI LS of 4 or greater. A CMT of each cow with a LS of 4 or greater may identify problem quarters to sample. Resample negative quarters with elevated SCC in 2 weeks.

Assuming that I have confirmed the existence of *Staph. aureus* in a high percentage of cows, what management steps should I take to solve the problem?

It is very important to begin a long-term prevention program as soon as practical. A combination control/prevention program will keep the problem from recurring. Keep in mind that every *Staph. aureus* infected cow is a potential source of infection for the rest of the herd.

STAPH CONTROL PROGRAM

The presence of *Staph. aureus* requires immediate action. This is an outline or steps for short and long term solutions to a *Staph. aureus* problem.

A. Cull chronically infected cows (clinical or non-clinical). But which cows should I cull?

First priority for culling should be older cows that have these characteristics:

- Chronic clinical mastitis for more than one lactation and marginal production.
- Monthly somatic cell counts that remain higher than 400,000 (linear score of 5) over two lactations.
- More than three treatments during the present lactation with no effect on either clinical or non-clinical signs.
- *Staph. aureus* cultured on 3 occasions from more than one quarter.
- Combination of problems: mastitis, reproduction, production and functional quarters.

The number of cows culled will depend on availability of replacements, cash flow situation of the dairy, bulk tank somatic cell count and individual cow production.

B. Segregate infected cows from non-infected cows during milking.

Which cows should be included in the segregated group?

The segregated infection group should include all cows that have been treated for mastitis during the present lactation, cows cultured positive for *Staph. aureus,* cows that have a somatic cell count consistently above 200,000 or a linear score of 4, or cows that have one quarter with a CMT of 1 or higher.

What method should I use to separate the infected cows?

There are at least three options with freestall housing that can use to segregate the infected and non-infected cows during milking time:

OPTION I -Establish a separate lot or group for Staph. aureus-infected cows. Milk these cows last. Culture all fresh cows by the 3rd or 4th milking or CMT all quarters (5th or 6th milking) before assigning each cow to either the infected group or non-infected group. To reduce the number of cows to culture, it is possible to screen all quarters with the CMT and culture only quarters that score a CMT 1 or greater. Cows treated for mastitis should be included in the infected group. Continuous (monthly or more frequently) SCC

monitoring of each cow will help to identify new *Staph. aureus* infection or aid in deciding if an infection has been cured.

Cows should leave the infected lot only through death or culling or by producing two consecutive negative cultures in a subsequent lactation following dry treatment. The monthly SCC for these cows should remain under 200,000. Any cow that has had a Staph aureus infection should be closely monitored for signs of re-infection. Since infected cows are more likely than the rest of the herd to become infected again, many farmers choose to keep the infected cow in the segregated infected group on a permanent basis.

A cow would move from the non-infected group to the infected group either when a case of clinical mastitis occurred or when a milk culture was positive for *Staph. aureus.* Remember, a somatic cell count greater than 200,000 (LS 4) from a cow that was previously considered non-infected indicates a need to culture a milk sample from that cow.

In *Staph. aureus* herds, cows with negative cultures but repeated SCC greater than 400,000 (LS 5) should be considered infected and kept with the infected cows. Continue to monitor cows with SCC between 200,000 and 400,000 as their *Staph. aureus* status is questionable. In a herd with 30% or more of cows infected with *Staph. aureus*, a SCC of 200,000 or more is very accurate in predicting the presence of *Staph. aureus* in one or more quarters.

OPTION 2-Use separate milking equipment for treated and infected cows, when the number of *Staph. aureus* infected cows is less than 10% of the milking cows.

The claw units used to milk infected cows should not be used to milk any non-infected cows. With this option, the infected cows would not have to be physically separated from non-infected cows, but they would need to be clearly identified at milking time.

OPTION 3-Backflush all milking units between cows.

(Table 1 outlines a true backflush routine.)

Some dairy farmers backflush claw units manually between cows, but this is time consuming (1 to2 minutes per unit). Commercial automatic backflush units are available and are effective at removing *Staph. aureus* organisms from teat cup liners. However, the cost of automated backflush units at $1,000 to $2,000 per unit. Segregation of infected cows may still be necessary in combination with backflush units as sources other than milking equipment may aid in the transfer of *Staph. aureus* infections at milking. Therefore, each farmer should determine the cost:benefit ratio of adding an automatic backflush cycle to the automatic detachers.

Iodine concentrations must remain at 25 ppm or higher during the backflushing cycle to remove *Staph. aureus* from teat cup liner surfaces. However, iodine and most silicone inflations are not compatible. Check with your dealer before using iodine backflushing with silicone inflations. The concentration of iodine delivered through the backflush units should be monitored on a daily basis.

Stall Barn Segregation Options

All *Staph. aureus* infected cows should be marked in some distinctive manner. Leg bands, colored neck chains or marker crayons could all be used to identify staph cows.

Option A – Milk **non**-*Staph. aureus* infected cows first and then the infected cows. This requires two trips by the milkers through the stall barn.

Option B – Designate specific milking units for infected and non-infected cows. Only one trip through barn will be necessary.

Option C – House non-infected cows at one end of the barn and milk them first. If cows are trained to use a particular stall, this will require re-training.

Under Options A and B, fresh cows can be milked last with the unit used for non-infected cows. Under Option C, fresh cows should be milked last with a separate milking unit designated for fresh cows.

C. What other management steps should I take?

- Dry off infected, known pregnant cows immediately if they are within 80 days of calving, and dry treat all four quarters with a commercial dry cow antibiotic. Culture these cows at the 3rd or 4th milking after calving to re-determine their *Staph. aureus* status. Infected cows that are not cured with dry cow therapy should be milk last or placed in an infected cow group. Chronically infected cows should

be designated for culling when milk production drops below an economic break-even threshold and a replacement is available to take their place.

- Postpone further purchases of cows and heifers until you have a Staph. aureus control and prevention program in place; that is, all infected cows are known and are being managed. If you need to purchase cows or heifers, you must first determine *the Staph. aureus* status of herds from which you are purchasing. If the herd will not provide the information, do not purchase cows or heifers from that herd. If you purchase cows and heifers from a herd of unknown *Staph. aureus* history, all animals should be considered infected until proven otherwise. These animals should be automatically segregated until their *Staph. aureus* status is determined.
- Segregate all lactating cows that have left the dairy for fairs, shows or exhibitions until a milk culture and/or SCC data proves the cow is not infected with *Staph. aureus*.
- Milk known non-infected first lactation cows first.
- Perform a total evaluation of milking equipment function, especially vacuum pump capacity, vacuum controller function, line sizes, vacuum level, pulsator function, detacher settings and inflation condition. Molded rubber inflations should be discarded after a maximum of 1,000 cow milkings.
- Have an independent person such as a fieldperson or consultant evaluate your milking procedures. Provide extensive training for new milkers.

- If you have not already done so, establish a post-milking teat dipping program using an effective germicidal teat dip. In known *Staph. aureus* herds, teats should be dipped (not sprayed) after milking with a 1% iodine dip containing 10% glycerine or similar emollients. The 1% iodine dip is the industry gold standard for teat dips. Predipping with an iodine sanitizer in addition to post-milking dipping may also be valuable in preventing *Staph. aureus* infections.
- Establish a total dry cow treatment program, using a commercially available antibiotic designed specifically for dry cows. Dry treat all cows in all quarters. Neither, double dose treatment nor two treatments a few days apart will increase cure rate. Treatment should be administered after the last milking.
- Cow should be milked 2 or 3 times per day until the last milking before dry off. Skip milking is not advised as it may lead to the development of clinical cases in cows with non-clinical infections.
- Provide adequate balanced rations for your herd, with special emphasis on vitamins, selenium and other trace minerals known to affect skin integrity and the immune system..
- Evaluate housing conditions for bred heifers, dry cows, cows at calving and lactating cows. Eliminate potential sources of teat injury. Cows with pendulous udders will be more prone to injury and *Staph. aureus* infections.
- Milkers must wear disposable gloves during daily milking routines. Their gloved hands should be sanitized often. Gloves will prevent chapping and cracking of

hand skin. Culture tests often indicate the presence of *Staph. aureus* on hands, but the bacteria are hard to eliminate from skin.

- Begin a fresh cow culture and CMT program to monitor the *Staph. aureus*-status of cows and heifers.

Individual Cow Therapy for *Staph. aureus* infections

The cost of intramammary drug treatment for *Staph. aureus* mastitis plus a 5 to 6 day milk discard period will exceed $100 for most cows. The expected cure rate for *Staph aureus* infections during lactation is approximately 20%. Extended treatment protocols (10 days or more) can be expected to slightly increase cure rate, but treatment costs will $200. Combination therapy with both intramammary and injectable antibiotics is slightly more beneficial (30% cure rate) than intramammary treatment alone. However, milk withdrawal time is also extended. There is no way to justify treatment of non-clinical *Staph. aureus* infections as the cure rate is so low and the cost is high. Treatment fails to address why *Staph. aureus* infections are occurring in the first place. Prevention and establishing a *Staph. aureus* management program are far more successful than any therapy.

Would vaccinating my herd help?

A good general vaccination program is recommended for any dairy herd to prevent diseases, but mastitis vaccinations that are currently available will not prevent *Staph. aureus* infections. *Staph. aureus* vaccines may lessen the impact of gangrenous mastitis in

heifers shortly after freshening. Research continues in an attempt to find more successful vaccines for control of *Staph. aureus*.

Is there anything I can do to prevent or reduce the chances of my herd becoming infected by *Staph. aureus*?

Yes. Naturally, a good prevention program begins with a dairy farmer or herdsperson who is truly interested in milking cows. The statement that mastitis is a man-made disease is true for many farms.

Important measures you can take include:

- Identifying all infected cows.
- Providing proper nutrition and general vaccination programs for heifers and cows.
- Providing clean, dry comfortable housing for cows and heifers along with a fly control program.
- Properly designed and maintained milking equipment, and proper usage of the equipment.
- Teat dipping with a germicidal dip. Teat dip should cover 50 to 100% of every teat. Persons milking cows should be evaluated periodically to assure that teats are being adequately covered.
- Dry treatment of all cows in all quarters with commercially available dry cow antibiotics.
- Enrollment in DHI or any other monthly somatic cell count program.

- Culling of chronically infected cows – either non-clinical or clinical.
- Limiting and managing the use of veterinarian-recommended antibiotics for treatment of mastitis during lactation. Treatment of *Staph. aureus* infections during lactation will cure less than 25 percent of infections; therefore, lactation therapy should be limited to severe clinical cases. All mastitis treatments should be recorded and evaluated for efficacy.
- Culturing all purchased heifers or cows and animals that have been off the dairy.
- The assumption that once you have a *Staph. aureus* problem, that every heifer or cow is infected with *Staph. aureus*. Therefore, all fresh cows must be monitored for infection-status by culture or CMT or both by the 3rd to 5th milking after calving. It is better to be safe than sorry. It only takes a few months for a few *Staph. aureus* infected cows to infect a high percentage of the herd.
- Raising quality heifers so that adequate numbers of replacement heifers are available to replace *Staph. aureus*-infected cows as needed.
- Monthly bulk tank culture to monitor herd's *Staph. aureus* status.
- Cooperating with your local veterinarian, milk cooperative fieldperson or other consultants to establish a *Staph. aureus* control and prevention program
- Keeping in mind that very high producing cows of exceptional merit that are infected with *Staph. aureus* do not always have to be sold. However, there must a plan to prevent the infected cow from infecting any other cows in the herd.

SOMATIC CELL COUNT AND EQUIVALENT DHIA LINEAR SCORES

Average Somatic Cell Count	DHIA Linear Score
12,500	0
25,000	1
50,000	2
100,000	3
200,000	4
400,000	5
800,000	6
1,600,000	7
3,200,000	8
6,400,000	9

Table 1

Backflush Routine

ST'EP	APPROXIMATE TIME ALLOWED
1. Running-water rinse	10-15 sec.
2. 25 ppm iodine flush	45 sec.-l minute
3. Running-water rinse	10-15 sec.
4. Water removal from claw	

This is one in a series of bulletins on mastitis control in dairy herds. Contact your county Cooperative Extension Service office for information on other forms of mastitis and how to control them.