TO DRY TREAT OR NOT TO DRY TREAT: MANAGING DRY OFF TO PRODUCE HIGH QUALITY MILK

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KEY TAKE HOME POINTS

1. The purpose of dry cow therapy is both therapeutic and prophylactic; selective DCT is aimed only at therapeutic aims
2. Cows that maintain persistent subclinical infections across the dry period are at greater risk of subclinical and clinical mastitis and reduced milk yield during the subsequent lactation
3. Few mastitis pathogens are resistant to most antimicrobials used in DCT
4. Research indicates that selective DCT programs can be successful if applied to rigorously screened herds and cows
5. Research also indicates that use of selective DCT without rigorous screening of herds and cows will result in increased CM and increased SCC

INTRODUCTION

The dry period is known to be an important risk period for mastitis. During the dry period, the mammary gland experiences physiologic changes which result in increased susceptibility of new intramammary infections (IMI).[1] Existing IMI (from the previous lactation) and new infections (that originated between drying off and calving) both contribute to the occurrence of subclinical and clinical mastitis in subsequent lactations. Mammary glands which become infected during the dry period produce less milk and are at a higher risk of mastitis in the subsequent lactation. The use of comprehensive antibiotic dry cow therapy (DCT) has long been recommended as the primary strategy to control mastitis during the dry and peri-parturient period. Most US dairy herds, use comprehensive DCT but in recent years, the routine use of antibiotics in dairy cattle has been challenged, and the use of selective dry therapy has been considered. The aim of this presentation is to provide practitioners with guidance about when selective dry cow therapy is advised and when it is not recommended.

PREVALENCE AND IMPACT OF IMI DURING THE DRY PERIOD

The prevalence of existing IMI at drying off varies enormously among herds and is influenced by the type of pathogens and management practices used in each herd. Review of individual SCC values at the end of lactation often indicate that >30% of cows may have subclinical infections, and prevalence usually increases with parity. Treatment of subclinical mastitis during lactation is not considered to be cost effective[2] so many farmers defer treatment of chronic subclinical infections until dry off, thus one purpose of DCT is to treat subclincally infected quarters. DCT is also used to prevent new infections during the high risk period surrounding involution. The incidence of new IMI acquired during the dry period varies among herds but often approaches about 10 to 17% of quarters with most of infections caused by environmental organisms.[3] Many of these infections can persist through the dry period and influence productivity and milk quality in the subsequent lactation. Researchers have reported that cows that maintain subclinical infections across the dry period have decreased milk yield,[4] increased SCC and increased risk of clinical mastitis in the subsequent lactation.[5]

The use of a selective DCT program is focused on identification and treatment of quarters that are infected at dry off, thus the therapeutic purpose of DCT is maintained. However, selective DCT programs purposefully disregard the prophylactic usage of dry cow antibiotics, so herds that consider the use of a selective DCT program must ensure optimal

management of dry cows to minimize the potential negative impacts resulting from development of new intramammary infections during the dry period.

RISK FACTORS FOR IMI DURING THE DRY PERIOD

The development of IMI during the dry period is a result of the balance between the intensity of exposure to environmental pathogens and the effectiveness of interventions. Conditions in dry cow housing areas are often neglected and result in considerable exposure to potential mastitis pathogens at the same time that many mastitis control procedures are discontinued. When lactation ends, teats are no longer sanitized or disinfected, which increases growth of opportunist bacteria such as CNS and other environment pathogens. Anatomic defenses are also important. Increasing parity is a well-known risk factor for development of IMI during the dry period, suggesting that anatomical or intramammary defense mechanisms of cows may deteriorate with age. Dry cows are at greater risk for developing new IMI because of physiological events such as termination of the flushing effect of milking on bacteria present in the mammary gland, increased mammary pressure (and subsequent leakage of milk) and reduction and changes in the population of defense cells and biochemical characteristics of the mammary secretion. Rapid growth of mammary tissue and production of large amounts of secretion are observed in the last 2 weeks of gestation. The resultant pressure can cause leakage of colostrum and variations in the teat canal which may increase susceptibility to IMI. Teat-end bacterial populations, integrity of the teat-end, and timely formation of the keratin plug are important risk factors that affect the probability of IMI during the dry period. Closure of the teat-canal can occur as soon as 16 days after dry off but 3-5% of quarters never close and 97% of clinical mastitis that occurred during the dry period occurred in quarters that did not have a keratin plug.[6] Failure to develop a keratin plug has been associated with high milk production. Teats were still open 6 weeks after dry off for half of cows that produced more than 21 kg of milk on the day before lactation ended.[7] Thus, high producing older cows are at increased risk for development of IMI during the dry period.

EFFICACY OF DRY COW THERAPY

The use of comprehensive DCT (administration of intramammary antibiotics to every quarter of all cows at the end of each lactation) was initiated as part of the 5-point mastitis control plan with the purpose of eradication of subclinical infections caused by *Streptococcus agalactiae* and *Staphylcococcus aureus*.[8] Research at that time reported that DCT cured 70-98% of existing IMI (depending on pathogen) and reduced the incidence of new IMI by about 50-75%. As the prevalence of these pathogens has declined[9] researchers have questioned the efficacy and utility of routine administration of DCT. French researchers performed a meta-analysis and determined that as compared to cows that received DCT, the pathogen specific relative risks of IMI for cows that did not receive DCT were 1.5, 2.3, 3.0 and 1.1 times greater for all pathogens, Strep.spp, Staph aureus, and CNS, respectively.[10] However, the use of DCT did not reduce the incidence of IMI caused by Gram-negative pathogens.

METHODS TO DETECT COWS BENEFITING FROM DCT

The use of comprehensive DCT was questioned as early as 1983 on the basis of concerns about “selection for heightened resisance”[11] and concerns usually focus on use of antibiotics to treat cows that may not benefit. The use of selective DCT is generally focused on using IMM antibiotics to treat cows that are suspected or confirmed to have active IMI. Thus, one key element of using a selective DCT program is to successfully identify infected cows. There are essentially 4 different methods that can be used to find cows that may benefit from selective DCT: 1) review the history of the cow (SCC or history of clinical cases); 2) use of CMT; 3) culture quarters using a specific or selective

test or 4) use of PCR testing. While each of these methods can identify some cows that will benefit from use of DCT, the false negative rate (number of truly infected cows that are not identified and treated) ranges from about 10-40% and one researcher concluded that "efficacy of prevention could be increased if all infected cows could be detected and treated."[12]

RESEARCH ABOUT SELECTIVE DCT

One researcher performed a negatively controlled, randomized clinical trial using 4 herds located in Ohio.[13] The herds varied greatly in BTSCC ranging from 162,000 to 340,000 cells/mL. Cows were assigned to the trial based on their SCC and CM history in the last 90 d of lactation. Cows with a SCC <200,000 cells/mL and no history of CM or SCC <100,000 cells/mL were randomly assigned to receive IMM DCT with cloxicillin or cephapirin or were assigned to a non-treated control group. Cows that did not meet those criteria all received DCT. No overall effects on milk yield were observed but there was a large herd effect. Overall, the SCC of quarters that did not receive DCT was 16% greater than the SCC of treated quarters. The authors concluded that in some herds the use of "blanket DCT" was beneficial while in other herds no DCT did not have a detrimental effect.

A recent Dutch study used SCC at the last monthly test to determine eligibility for a split-udder protocol that compared the use of IMM penicillin/novobiocin to no treatment.[14] The researchers enrolled 1697 cows from 97 herds, without any herd-level eligibility criteria. While the authors were able to reduce the overall use of antibiotics by about 85%, quarters that did not receive DCT had increased odds of clinical mastitis during the dry and postpartum period and during the first 100 DIM. The SCC of non-treated quarters was also increased when DCT was not administered. The authors concluded that the use of selective DCT resulted in large reductions in antibiotic usage but increased mastitis.

In contrast, Canadian researchers enrolled cows (n = 729) from 16 herds using stringent herd and cow-level eligibility criteria.[15] Herds were required to have BTSCC <250,000 cells/mL and cows were eligible if they had SCC<200,000 cells/mL and no clinical mastitis in the previous 90 days and all quarters were CMT <2 at the time of dry off. Of 1584 in the herds, only 46% met eligibility criteria. Half of the cows received comprehensive DCT and internal teat sealant while the other half of the cows were screened using Petrifilm® aerobic count plates to determine if they were microbiologically positive. Cows with composite milk samples that contained >50cfu/mL of bacterial growth received IMM using ceftiofur and an internal teat sealant while cows that were culture negative received simply the internal sealant. The authors reported no difference in milk yield, IMI, CM or SCC in the subsequent lactation that could be attributable to use of comprehensive DCT. However, it is important to note that the animals enrolled in this study had exceptional udder health as the median SCC was <40,000 cells/mL and the incidence of CM in the first 120 d was <8%. The authors concluded that in this population, the use of selective DCT did not influence milk quality nor yield.

RECOMMENDATIONS AND CONCLUSION

One management objective for the dry period is to minimize the number of quarters that are infected at calving. One of the most effective strategies is the use of comprehensive dry cow therapy. Administration of DCT to all quarters is successful in curing many existing subclinical infections as well and offering short-term protection against new IMI when susceptible pathogens invade the gland during the early dry period. While there is no evidence that has linked the use of comprehensive DCT to development of antibiotic resistance, political pressure for reductions in use of antibiotics on dairy farms has

increased interest in use of selective DCT. Recent research about selective DCT suggests that the use of selective DCT in randomly selected herds will decrease antibiotic usage but result in increased mastitis and SCC values. However, the use of selective dry cow therapy in carefully screened herds, can decrease antibiotic usage without increasing mastitis. Detection of cows that will benefit from selective DCT requires consideration of multiple factors and there is no specific test that reliably detects all cows that will benefit from DCT. While all veterinarians should promote judicious usage of antimicrobials, it is important to recognize that there are no studies that indicate that use of selective DCT programs result in reduced development of antimicrobial resistance.

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