An Epidemiologic Study Evaluating Therapies for Bovine Mastitis

W.M. Sischo, G.W. Rogers, L.I. Bieler, J.B. Cooper
Depts. of Veterinary and Dairy and Animal Science
Penn State, University Park PA 16803, USA

One recommended element of a comprehensive mastitis control program is to treat all cases of clinical mastitis with an appropriate antibiotic. There is good evidence that antibiotics are not effective treating coliform mastitis and recent data suggests that antibiotics may have no effect on the clinical course of mastitis. Our study examined the utilization and effectiveness of different therapies for the treatment of naturally occurring mastitis. A cohort study followed 5 Pennsylvania (USA) dairy herds over four years. The study utilized producer collected data and samples, including milk from clinical quarters for microbiology ; and information on initial severity of the clinical mastitis, treatment choice, and 30 day assessment of the course of the mastitis. Production data were obtained from DHIA records, and only first clinical cases involving a single quarter and pathogen were used in this study. The primary analytic outcome was the number of days for the for the quarter and milk to return to normal (DTN). A total of 367 clinical cases were evaluated. Four categories of treatment were defined: no antibiotics used, intramammary beta-lactams, intramammary ceftiofur, and miscellaneous therapy. The most common treatment was intramammary ceftiofur used in 39% of the clinical cases. No antibiotic therapy was chosen in 14% of the cases. In this study only one of the farms treated all clinical cows with some form of antibiotic. The Cox Proportional Hazards Model, which controlled for initial severity, showed no effect of therapy on DTN. Of all variable examined, initial severity score best predicted DTN. Further analysis will examine the antibiotic effect on microbiologic cure, DTN conditional on bacterial cause, and production.

Segregation or Use of Separate Milking Units for *Staphylococcus aureus* -Infected Dairy Cows

David J. Wilson, Ruben N. Gonzalez
Quality Milk Promotion Services
College of Veterinary Medicine
Cornell University
Ithaca, NY 14850

Philip M. Sears
Department of Large Animal Clinical Sciences
College of Veterinary Medicine
Michigan State University
East Lansing, MI 48824

Abstract

Seventy six dairy herds with initial prevalence of *Staphylococcus aureus* IMI 3 10% were included in this study. Farm managers did not elect to change teat dipping or dry cow treatment practices, were not segregating cows that were positive for *S. aureus* at the initial visit, and did not cull >50% of those found positive on the initial visit. During a 6-to-24 month follow-up period, segregation or separate milking of cows that were positive for *S. aureus* resulted in reduction of prevalence from 29.5 to 16.3%, and bulk tank SCC from 600,000 to 345,000/ml. Prevalence of *S. aureus* mastitis was unchanged for farms not segregating *S. aureus* cows, 22.5 to 20.2%. Change in SCC from 698,000 to 484,000 for nonsegregated herds was less of a reduction than for segregating farms. Segregation or use of a separate milking unit for cows known to be positive for *S. aureus* is an effective mastitis control practice.

Introduction

Staphylococcus aureus remains a major contagious mastitis of financial importance in dairy herds.[5] Of dairy herds surveyed in the Northeast, mastitis caused by *S. aureus* is present in 78.7%.[8] Culling of all infected cows (especially younger or high production animals) is not usually cost-effective or practical,[4] considering that *S. aureus* mastitis is not an eradicable disease. An important cause of spread of this disease is cow-to-cow transmission at milking time, particularly on inflations of the milking units.[1,6] A retrospective study was conducted to determine whether segregation of cows with *S. aureus* mastitis by milking positive cows last or with separate milking units is effective in reducing prevalence of this mastitis.

Approximately 2800 dairy herds were visited by personnel from the Central and Eastern Laboratories of the Quality Milk Promotion Services (QMPS) at Cornell University between January 1992 and July 1994. The farms were located in central and eastern New York and northern Pennsylvania. The majority of the herds visited (66%) used this service as a monitoring tool once or twice per year, and 34% did so in response to bulk milk SCC >750,000/ml. A sample of 76 farms which met the criteria for this retrospective study was drawn from this group.

Materials and Methods

Composite milk samples were aseptically collected from all lactating cows in 99% of the herds visited, and from cows with a DHIA SCC linear score of >4.5 for the rest of the herds. Microbiological culture was performed as described previously.[2]

During the 2-yr study period, 76 dairy herds from among the 2800 visited by the QMPS met the following criteria: 1) initial prevalence of *S. aureus* IMI of 310% found on culture from the entire lactating herd, 2) at least one follow-up culture of the entire lactating herd between 6 and 24 mo later, 3) no change in teat dipping or dry cow treatment practices, 4) were not segregating cows that were positive for *S. aureus* at the initial visit, 5) culled £50% of the cows that were positive for *S. aureus* on the initial visit. The latter three practices were monitored by completion of a management questionnaire on the farm, which was updated at each follow-up telephone call and at subsequent farm visits. Culling of <50% of cows that were positive for *S. aureus* was verified by confirming that the majority of cows positive on the initial herd visit were still present in the herd at the second visit.

Adoption of suggested management changes and timing of the farm visits were by mutual agreement of the farm management and QMPS. Segregation of cows that were positive for *S. aureus* was recommended to all dairy producers, as was adoption of teat dipping and dry cow therapy if these measures were not already in use. Prevalence of *S. aureus* at the last visit (regardless of how many visits were made) during the follow-up period (6 to 24 mo) was compared with prevalence at the first visit. Somatic cell counts in bulk milk as measured by the laboratory of the farm's receiving milk plant were also compared.

Statistical Analysis

Paired *t* tests were used to test for significant changes in *S. aureus* prevalence or bulk milk SCC within segregating and nonsegregating herds. Comparisons among the two groups (segregating and nonsegregating) for *S. aureus* prevalence at end of follow-up, change in *S. aureus* prevalence, bulk milk SCC at end of follow-up, and change in SCC were performed using Wilcoxon rank sum tests. Rank sum tests were used instead of paired *t* tests because the two groups differed in sample size and sample variance. Analysis was performed using STATISTIX.[7]

Results

Segregation of cows that were positive for *S. aureus* by either milking them last or with separate milking units was practiced by 21 farms, but not by 55 farms. Of the 76 farms, 69 used postmilking teat dipping, and 75 treated all cows with a dry cow product at the end of lactation. Mean herd size was 59 lactating cows, and herd size ranged from 28 to 436 cows. Percentage of herds teat dipping, using dry cow treatment, and mean herd size were not different among segregation groups.

All 76 farms had at least one follow-up survey of mastitis prevalence of the entire herd. Two follow-up visits (3 total) were conducted on 57 farms, and 3 follow-up visits (4 total) were conducted on 37 farms. All findings at subsequent visits were compared with initial visits, but the only significant results were based on analysis of the last visit compared with the first visit (n = 76). Mean number of visits (3.5 per herd) did not differ among groups. Distribution of herds among time intervals until the last herd visit was as follows: 6 to 12 mo, 30 herds; 13 to 23 mo, 37 herds; 24 mo, 9 herds; and was also the same among the segregation groups.

Beginning levels of SCC and initial prevalence of *S. aureus* were the same among herds that elected to segregate and those that did not. Ranges of initial herd prevalence of cows that were positive for *S. aureus* were: 10 to 15%, 30 herds; 16 to 49%, 41 herds; >50%, 5 herds; these also were not different among the two groups. Segregation or separate milking of cows that were positive for *S. aureus* resulted in reduction of prevalence from 29.5 to 16.3% ($\underline{P} < .05$; *t* test) and bulk tank SCC from 600,000 to 345,000/ml ($\underline{P} < .05$; *t* test). Prevalence of *S. aureus* remained unchanged in herds not segregating cows, 22.5 to 20.2%. The SCC in nonsegregating herds dropped significantly also from 698,000 to 484,000

($\underline{P}$ <.05). However, reduction in SCC was significantly greater for segregating herds, and the ending SCC of 345,000 was significantly lower than the 484,000 level achieved by nonsegregating herds ($\underline{P}$ <.001; Wilcoxon rank sum).

Discussion

In this study, bulk milk SCC decreased in herds segregating cows that were positive for *S. aureus* more than it did for nonsegregating herds. The latter group of farms decreased in SCC also; farms with a mean SCC of nearly 700,000/ml are facing the possible loss of their milk market. When presented with a diagnosis of a high prevalence of *S. aureus* mastitis (in this sample the mean was greater than 20%), it is common that herd management will cull at least some cows identified by individual SCC testing or CMT testing as high SCC cows. Maintaining teat dipping, dry cow therapy, or culling rate practices does not preclude most dairy farmers in such circumstances from attempting to reduce SCC immediately by culling or by early dryoff of a few problem cows; this likely explains why even nonsegregating herds used the mastitis diagnostic information to make some progress. However, the results suggest that lower SCC and prevalence of *S. aureus* can be attained by segregation.

The goal of the authors in this retrospective analysis was to control for the influence of major mastitis control practices such as teat dipping, dry cow therapy, and heavy culling of known positive cows. The study population consisted of farms with a high prevalence of *S. aureus* that did not change the aforementioned practices (to the extent that this could be verified by follow-up contact, observation of management practices, and direct identification of surviving positive cows on the second farm visit). The major difference between the two groups of dairy farms studied was whether or not cows that were known to be positive for *S. aureus* were milked last or with separate milking unit(s). An earlier study found that four segregating herds did not have significant differences in incidence or prevalence of *S. aureus* IMI from five control herds.[3] However, incidence was 14% less within the segregating herds, and except for 3 cold winter months, during which time one of the segregating herds ceased dipping teats and had a 20% increase in herd prevalence over 3 months, incidence of *S. aureus* IMI was lower in segregating herds.[3] One segregating herd was the only herd to achieve 0% infection rate with *S. aureus* IMI. The authors of the study concluded that segregation may be an effective component of control of *S. aureus* mastitis. An excellent point was made by those authors: segregation should be only one part of a mastitis control program which includes milking time hygiene.[3]

It is practical for dairy herds with any type of housing, milking facility, or size to milk cows that are positive for *S. aureus* last or with a separate milking unit (or units) for these cows. Most herds prefer to identify distinctively, usually by leg bands, the cows with *S. aureus* IMI and milk them with units identified as only for use on those cows. The teat cup inflation is the major fomite of cow to cow transmission of new IMI with this pathogen.[1,6]

Avoidance of using inflations from cows known to be positive for *S. aureus* to milk those cows presumed to be free of *S. aureus* mastitis should reduce rate of new IMI, and therefore prevalence, over time. Results of this study suggest that prevalence of *S. aureus* mastitis and bulk milk SCC are reduced significantly by milking these infected cows separately or last.

Acknowledgments

The authors thank Lisa Hildebrandt for assistance with statistical analysis.

References

1. Bramley AJ. 1992. Mastitis and Machine Milking. Page 355 in Machine Milking and Lactation. AJ Bramley, FH Dodd, GA Mein, JA Bramley, ed. Insight Books, Berkshire, UK. 2. Dinsmore RP, English PB, Gonzalez RN, *et al*. 1992. Use of augmented techniques in the diagnosis of the bacterial cause of clinical bovine mastitis. *J Dairy Sci*. 75:2706. 3. Fox LK, Hancock DD. 1989. Effect of segregation on prevention of intramammary infections by *Staphylococcus aureus*. *J Dairy Sci*. 72:540. 4. Hoblet KH, Miller GY. 1991. Use of partial budgeting to determine the economic outcome of *Staphylococcus aureus* intramammary infection reduction strategies in three Ohio dairy herds. *J Am Vet Med Assoc*. 199:714. 5. Nickerson SC. 1993. Preventing new *Staphylococcus aureus* intramammary infections. *Vet Med*. 88:368. 6. Schalm OW, Carroll EJ, Jain NC. 1971. The Staphylococci. Page 222 in Bovine Mastitis. Schalm OW, Carroll EJ, Jain NC, ed. Lea and Febiger, Philadelphia, PA. 7. STATISTIX™, Analytical Software, St. Paul, MN. 8. Wilson DJ, Gonzalez RN, Sears PM. 1994. Bulk tank and individual cow milk cultures for detection of contagious mastitis pathogens before adding purchased animals to dairy herds. Page 3 in Proceedings of the American Association of Veterinary Laboratory Diagnosticians, Grand Rapids, MI.