National Mastitis Council
A Practical Look at Environmental Mastitis

Bacteria that most frequently cause mastitis can be divided into two large groups based on the source of the bacteria: contagious pathogens and environmental pathogens. The primary contagious pathogens are Streptococcus agalactiae, Staphylococcus aureus and Mycoplasma species. Primary environmental pathogens include two types of bacteria: coliform bacteria and species of streptococci other than Strep. agalactiae. These other streptococci are referred to as the "environmental streptococci".

The primary source of environmental pathogens is the surroundings in which a cow lives. The sources of contagious mastitis, however, are infected cows and transmission is from cow to cow. Therefore, methods of control developed for the contagious pathogens are not effective against environmental pathogens.

ENVIRONMENTAL STREPTOCOCCI

Detection by Culture of Milk

Environmental streptococci can be reliably cultured from milk of infected quarters by plating .01 ml of milk on esculin blood agar. Milk from infected quarters generally contain greater than 100 colony forming units per ml.

Intramammary Infection Rate

The rate of new intramammary infections (the number of new infections per cow-day) is higher during the dry period than during lactation. Without dry cow therapy, the rate increases dramatically the first two weeks of the dry period and again during the two weeks before calving. With each successive dry period, the rate of dry period intramammary infection increases.

During the first 75 days postpartum, the rate of infection is higher than it is during the remainder of lactation. Rate of streptococcal infection increases progressively as lactation number increases.

Duration

Approximately 60% of streptococcal intramammary infections are present less than 30 days, but about 18% become chronic and persist more than 100 days. About 40% of the infections present during lactation are eliminated spontaneously.

Prevalence

The percentage of quarters infected with environmental streptococci at any one point in time is generally low and seldom exceeds 10% of quarters.

Herd Monitoring Methods

The impact of environmental streptococci mastitis is best assessed by bacteriologic culturing of milk from fresh cows, cows going dry, and clinically infected quarters. Individual cow somatic cell counts and whole-herd cultures are less effective monitoring schemes.

Bulk tank milk bacterial and somatic cell counts can be elevated by intramammary infections caused by environmental streptococci. However, the impact of environmental streptococci in a dairy herd cannot be reliably assessed by those measurements.

COLIFORM BACTERIA

The coliform bacteria that cause mastitis include Escherichia coli, Klebsiella pneumoniae, Klebsiella oxytoca and Enterobacter aerogenes.

Detection by Culture of Milk

Coliform bacteria are not reliably cultured from milk of infected quarters by streaking .01 ml of milk on esculin blood agar. Colony-forming units per ml are frequently less than 100, or below the minimum detection limit of this method. Streaking .01 ml of milk on esculin blood agar and .1 ml on one half of MacConkey agar facilitates the diagnoses.

Intramammary Infection Rate

Coliform intramammary infection rate is about four times greater during the dry period than during lactation. The rate is markedly higher during the first two weeks of the dry period, as well as the two weeks before calving. The rate increases with each succeeding dry period.

The intramammary infection rate is highest in the early stage of lactation and decreases as lactation advances. The rate increases with each succeeding lactation.

Duration Coliform intramammary infections tend to be of short duration. More than 50% last less than 10 days and nearly 70% less than 30 days. Coliform infections can become chronic. Thirteen percent have been found to persist for more than 100 days. However, only 1.5% of the E. coli infections exceed 100 days in duration.

Prevalence

The percentage of quarters infected at anyone time is generally very low. Typically, 1% or less of the quarters are shown to be infected, but coliform bacteria may cause as many as 30% to 40% of clinical mastitis cases.

Herd Monitoring Methods Accurate records of new clinical cases, together with milk cultures from clinically infected quarters, help to assess the impact of coliform mastitis. This impact cannot be reliably assessed by bulk tank somatic cell counts, individual cow somatic cell counts, whole-herd cultures, culture of a subpopulation of cows, or culture of bulk tank milk.

THE ENVIRONMENT

Housed cows are at greater risk for environmental mastitis than cows on pasture. Sources of environmental pathogens include manure, bedding, feedstuffs, dust, dirt, mud and water.

Bedding materials are a significant source of teat end exposure to environmental pathogens. The number of bacteria in bedding fluctuates depending on contamination (and therefore availability of nutrients), available moisture and temperature. Low-moisture inorganic materials, such as

sand or crushed limestone, are preferable to finely chopped organic materials. In general, drier bedding materials are associated with lower numbers of pathogens. Warmer environmental temperatures favor growth of pathogens; lower temperatures tend to reduce growth.

Finely chopped organic bedding materials, such as sawdust, shavings, recycled manure, pelleted corncobs, peanut hulls and chopped straw, frequently contain very high coliform and streptococcal numbers. With clean, long straw, coliform numbers are generally low; but the environmental streptococcal numbers may be high. Attempts to maintain low coliform numbers by applying chemical disinfectants or lime are generally impractical because frequent, if not daily, application is required to achieve results. Total daily replacement of organic bedding in the back third of stalls has been shown to reduce exposure of teat ends to coliform bacteria.

Environmental conditions that can increase exposure include: overcrowding; poor ventilation; inadequate manure removal from the back of stalls, alleyways, feeding areas and exercise lots; poorly maintained (hollowed out) free stalls; access to farm ponds or muddy exercise lots; dirty maternity stalls or calving areas; and general lack of farm cleanliness and sanitation.

CONTROL

Control of environmental mastitis is achieved by decreasing teat end exposure to potential pathogens or increasing the cow's resistance to mastitis pathogens.

Teat Dipping -- Germicidal Dips. Postmilking teat dipping with germicidal dips is recommended. A degree of control over the environmental streptococci is exerted, but there is no control of coliform intramammary infection.

Teat Dipping -- Barrier Dips. Barrier dips, postmilking, are reported to reduce new coliform intramammary infections. Their efficacy against the environmental streptococci and the contagious pathogens appears to be lower than that of germicidal dips.

Teat Dipping -- Dry Period. Attempts to control environmental mastitis during the dry period, using either germicidal or barrier dips designed for use during lactation, have been unsuccessful. Recent research on persistent barrier dips (two-five day persistency) applied in the dry period showed considerable promise for controlling environmental infections.

Dry Cow Therapy. Dry cow therapy of all quarters of all cows is recommended. Dry cow therapy significantly reduces new infections by environmental streptococci during the early dry period, but not the week or two before calving. Dry cow therapy does not control coliform infections. Reinfusion of antibiotics during the latter part of the dry period appears to be of little or no value.

Lactating Cow Therapy. Cure rates following therapy during lactation are generally about 50 to 60% for the environmental streptococci. Antibiotics approved for lactation therapy are uniformly ineffective against coliform, but cure rates may appear to be as high as 50% due to the short duration of infections.

Backflushing. Backflushing of the milking unit does not control environmental mastitis.

Milking Machine Function. Malfunctioning milking machines, that result in frequent liner slips and teat impacts, can increase cases of environmental mastitis.

Udder preparation. Milking of cows with wet udders and teats is likely to increase the incidence of environmental mastitis. Teats should be clean and dry prior to attaching the milking unit. Washing the teats, not the udder, is recommended.

Predipping. Predipping teats with a germicidal teat dip reduces new cases of environmental mastitis during lactation. Extreme caution should be taken to ensure that the teat dip is removed from the teats before milking machine attachment to prevent contaminating the milk.

Immunization. Immunizing cows during the dry period with an Escherichia coli J-5 bacterin will reduce the number and severity of coliform clinical cases during early lactation.

Diet. Feeding diets deficient in vitamins A or E, beta-carotene, or the trace minerals selenium, copper, and zinc will result in an increased incidence of environmental mastitis.

Environmental Management. Herd environments should be as dry and clean as possible. The environment of the dry, springing and maternity cow is as important as that of the lactating cow.

Taken in part from: A Practical Look at Environmental Mastitis. J.S. Hogan and K.L. Smith, Compendium on Continuing Education for the Practicing Veterinarian. Volume 9, no. 10. 1987. p. F342

(National Mastitis Council Factsheet, Revised 10/97)