

New Perspectives in Udder Health Management

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KEYWORDS

• Mastitis • Udder health • Milk quality • Dairy

KEY POINTS

- The nature of mastitis is changing, and environmental mastitis pathogens cause most cases of mastitis on many modern dairy farms. These pathogens often cause mild cases of clinical mastitis, but some can become host adapted and behave similar to contagious pathogens.
- Clinical mastitis is often more difficult to monitor than subclinical disease, and successful control programs are based on effective detection, proper diagnosis, and identification of cow-level risk factors that influence treatment outcomes.
- Barriers to improvement of milk quality are often related to failure to motivate farm personnel rather than lack of technical knowledge or skills. Development of integrated udder health plans and increased involvement in udder health programs are potential growth areas for veterinarians.

Ensuring production of high-quality milk from healthy cows is the primary objective of many veterinarians who work with dairy farmers. However, despite decades of implementation of control programs, mastitis continues to be the most frequent and economically challenging disease of dairy cows. Mastitis is a unique disease because it directly affects the mammary gland, reducing both the quantity and the quality of milk. Among diseases of dairy cows, mastitis is the only disease that can result in reduced value of the milk, and many processors pay significant monetary premiums to encourage production of high-quality milk. Control of mastitis has been influenced by changes in the dairy industry. Structural shifts in the US dairy industry have resulted in dramatic changes in the way that dairy cows are housed and managed. In 2009, dairy farms housing more than 500 cows contained 56% of cows and produced almost 60% of all milk produced in the United States.¹ These shifts in farm structure have resulted in management changes that have impacted the distribution of mastitis pathogens. While *Staphylococcus aureus* remains a significant cause of mastitis in

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some countries,^{2,3} widespread adoption of the “5-point plan” (1: post-milking teat disinfection, 2: universal administration of dry cow therapy, 3: appropriate treatment of clinical cases, 4: culling of chronically infected cows, and 5: regular milking machine maintenance) has resulted in significant reductions in prevalence of mastitis caused by contagious pathogens (*Streptococcus agalactiae* and *S aureus*).⁴⁻⁶ These trends are especially evident when reviewing microbiological results of milk samples obtained from cows with cases of clinical mastitis (Table 1). Studies conducted outside of the United States tend to report greater prevalence of clinical mastitis caused by *S aureus* compared to US studies (see Table 1). Recovery of the “traditional” mastitis pathogens such as *S agalactiae* or *S aureus* tends to more frequent in regions that are populated by a greater proportion of smaller herds in which tie stall facilities are used² or herds in which the use of well-known preventive strategies such as comprehensive use of intramammary antimicrobials at dry off have not been implemented.¹⁴

In response to the changing distribution of pathogens, udder health programs are increasingly focused on prevention of mastitis caused by environmental pathogens. The term “environmental pathogen” is used to refer to mastitis caused by opportunistic bacteria that reside in the environment of the cows. Common environmental mastitis pathogens include both gram-negative bacteria (such as *Escherichia coli* and *Klebsiella* spp) and gram-positive bacteria (such as *Streptococcus uberis* and *Streptococcus dysgalactia*). Environmental pathogens tend to be less adapted to survival in the udder, and intramammary infection often triggers an immune response that results in mild to moderate clinical symptoms. The duration of infection with environmental pathogens varies among pathogens¹⁵ and can be associated with the degree of host adaptation of the pathogen. Some environmental pathogens (such as most *E coli*) are truly opportunistic and the immune response is often successful in eliminating these pathogens after a brief period of mild clinical disease. Other environmental pathogens (such as many intramammary infections caused by streptococci or *Klebsiella* spp) seem to have become more host adapted and may present as mild clinical cases that erroneously appear to resolve when in actuality the case has returned to a subclinical state. Control of mastitis caused by environmental pathogens can be more complex than control of mastitis caused by contagious bacteria. Bedding materials, moisture, mud, and manure in cow housing areas are common reservoirs for these pathogens, and the standard udder health programs have been expanded into a 10-point plan that includes management procedures that focus on reducing exposure to these pathogens.¹⁶ The purpose of this review is to present new developments in udder health programs and explore ways to strengthen veterinary involvement.

UDDER HEALTH AND MOLECULAR METHODOLOGIES IN THE ERA OF ENVIRONMENTAL PATHOGENS

The classification of mastitis as “contagious” or “environmental” has traditionally been based on the primary reservoir and most likely mode of transmission of mastitis pathogens. Using the traditional classification, the udder of cows with subclinical infections serves as the primary reservoir for contagious pathogens. Transmission of contagious pathogens occurs when teats of healthy cows are exposed to organisms present in milk that originated from infected udders. The most common point of exposure is bacteria present in milk droplets on teat contact surfaces such as milking inflations. In the United States, the most common contagious mastitis pathogens are *S aureus* and *Mycoplasma bovis* but a few herds may still experience problems with *S agalactiae*.¹⁷ However, transmission via a “contagious route” is possible for any

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