New York State Cattle Health Assurance Program

Mastitis Module

The Milking Machine and Mastitis

The degree to which the milking machine is responsible for new infections of mastitis is unknown and it remains a source of controversy within the dairy industry. The role of the machine in causing mastitis may be overestimated because mastitis is often difficult to produce by experimental modification of milking machine parameters.

Although the rate of new infections caused by the milking machine is low it is recognized that the milking machine may contribute to an increased incidence of mastitis in the following ways:

- It can serve as a fomite for the transfer of contagious organisms from cow to cow,
- It may reduce resistance of the streak canal by traumatizing the tissue and creating teat-end lesions,
- The machine can provide the means for transfer of infection from one quarter to another of the same cow (creating cross infections), and
- The machine may produce differential vacuum forces sufficient enough to propel pathogen laden milk droplets through the streak canal into the teat cistern.

The Machine as a fomite

Machine liners act as fomites for the transfer of pathogens from cow to cow. Milk from infected cows coat the liners and milk residues collect in the claw assembly. This provides a source of bacterial contamination to the teats of subsequently milked cows. Overused rubber inflations will develop microscopic fissures that will harbor additional numbers of mastitis pathogens which can be released into the milk environment and serve as a continuous source of infection of susceptible animals.

Sanitary milking procedures, including the development of postmilking teat dips lower the new infection rate. Backflushing systems can drastically reduce cow to cow transfer of pathogens on liners. However, the effect of backflushing on the new infection rate has been disappointing ineffective.

Teat-end trauma and machine factors

High vacuum levels and improper use of the milking machine have been associated with teat orifice erosion and hyperkeratosis. However, there appears to be no association between vacuum level and new infection rate. The development of teat end lesions can create an environment for the concentration of and colonization of, damaged tissue by a variety of mastitis pathogens. Increased new infections from *Staphylococcus aureus* and *Streptococcus dysagalactia* are commonly associated with an increase in or high level of teat-end lesions.

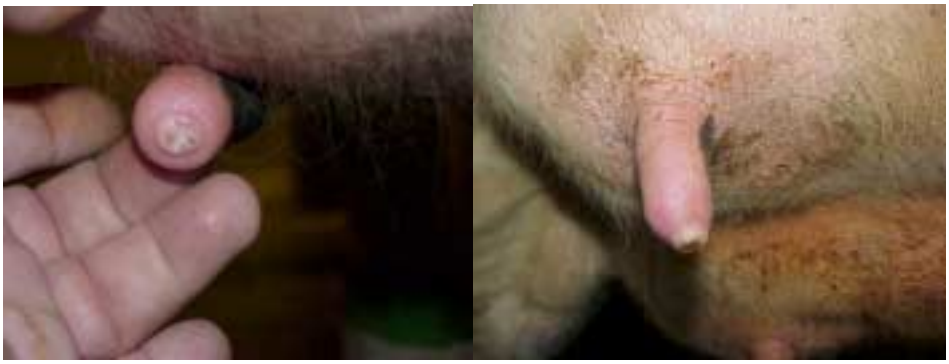
Milking conditions that lead to the development of teat end lesions include:

- Abnormally high teat end vacuum.
- Over-milking combined with other faults including **vacuum fluctuations** or **inadequate pulsation** can exacerbate the incidence of mastitis. Over-milking in its own right, however, is not regarded as a major cause of mastitis.
- Inadequate pulsation (insufficient or ineffective teat end massage) will increase the new infection rate. The absence or near

absence of pulsation consistently results in an increase of the new infection rate.

The use of teat dip containing skin conditioners or emollients, such as glycerin, may delay the onset or decrease the severity of teat end lesions by maintaining a moist, pliable, more resilient skin.

Teat orifice lesions show increasing levels of hyperkeratosis.



Teat end lesions demonstrating extensive hyperkeratosis, and skin erosions.

Vacuum fluctuations, impacts and mastitis

Vacuum fluctuations have been the object of controversy for a number of years. Teat-end vacuum fluctuations can be characterized as cyclic fluctuations due to liner wall movement during pulsation. Irregular or cyclic vacuum fluctuations occur with corresponding system vacuum fluctuations. Common causes of irregular fluctuations include inadequate vacuum pump capacity, system leaks or poor regulator performance. Irregular fluctuations are clearly associated with liner slips or squawking. Removal of the milking unit under vacuum, machine stripping or any other procedure that allows rapid admission of air into the mouthpiece can lead to milk impacts and increase infection rates. It is obvious that careless application or detachment of the milking machine may increase the rate of new infections. Severe vacuum fluctuations can cause bacteria laden milk droplets to flow in reverse direction and impact the teat end and enter the teat sinus, thereby creating an opportunity for new infection. It is possible for organisms at the teat end or existing within the streak canal to be propelled into the teat cistern by high-speed pressure fronts that accompany the abrupt loss of milking vacuum. Impacts occurring toward the end of milking are most likely to create a new infection.

There are major differences among liners and their slip or squawking characteristics. Liner

design is complex because it relates to both milking characteristics and slip frequency. Bore size, mouthpiece rigidity and curvature of the shoulder all influence slip frequency. Narrow bore liners and liners with more flexible mouthpieces have a greater tendency to slip than wide bore liners or those with more rigid mouthpieces.

Impacts and risk of infection may be reduced in several ways.

- Teats should be clean and dry prior to machine attachment. Drying increases the friction between the liner and teat skin while reducing the number of pathogens at the teat end.

- Milking machines should be carefully and gently applied, adjusted and removed, thereby avoiding sudden losses of vacuum during attachment and removal. Proper adjustment of the machine and support structure is necessary to minimize the chances of liner slip due to unit misalignment.

- Maintain the machine in optimum operating condition and maintain vacuum levels within proper operating ranges recommended by the manufacturer.

- Provide adequate vacuum supply with sensitive controls.

- Select liners with low liner slip characteristics.

Inflations and Mastitis

Liners or inflations can dramatically influence udder health. Liner properties can contribute to or prevent clinical mastitis and infection rate. Trauma produced to mucus membranes lining the teat sinus produced by inappropriate liners (hard mouthpiece, excessive vacuum or high liner mouthpiece vacuum) can contribute to bacterial infection and mastitis.

Overused or worn linerswill not provide adequate massage and can harbor pathogenic bacteria within microfissures that develop as the liner material degenerates with continued use, washing and disinfection.

Summary

The mechanical milking system is probably the most used piece of equipment on the dairy farm. Many systems are now operating twenty hours or more each day. The system is used to harvest the primary crop of the dairy farm, milk. It must do so in an efficient and effective manner that will not cause adulteration of milk in an unwholesome or unhealthy (cows) manner. Proper design and maintenance of the system is critical to those ends. Milkers must be trained to operate the system properly, understand the need for deliberate and consistent milking procedures, and must be aware of the consequences or improper use and inadequate maintenance of the system.

Over the years evidence has accumulated to show that mastitis can be reduced by improved design, maintenance and operation of milking equipment. Machines are rarely the sole cause of mastitis. The relationship among the milking system, the farm environment and human milking practices is such that it is difficult to isolate one specific factor as the major cause of mastitis. Good mastitis control requires more than good design. It also demands effective teat disinfection, adequate housing and environment management that keeps the cows and teats clean and dry and proper training of milking personnel.