

MASTITIS: INVOLVEMENT OF MILKING EQUIPMENT AND STRAY VOLTAGE



BASICS

OVERVIEW

- Proper milking equipment function minimizes trauma to bovine mammary tissue and transmission of mastitis pathogens between cows.
- Malfunctioning milking equipment may affect teat condition resulting in increased mastitis incidence. It is highly recommended to have new equipment tested by a professional before first use.
- Other factors such as milking hygiene, herd management and udder conformation play a larger role in mastitis.
- Complete protocols for teat and milking equipment evaluation are available from Teat Club International and National Mastitis Council (NMC) (referenced below).

INCIDENCE/PREVALENCE

10-20% of new infections within a herd may be caused directly or indirectly by milking equipment.

GEOGRAPHIC DISTRIBUTION

Worldwide

SYSTEMS AFFECTED

Mammary

PATHOPHYSIOLOGY

Milking machines may directly or indirectly affect the incidence of new infections by inducing changes on udder health such as:

- Congestion and/or edema of the teat leading to delayed sphincter closure.
- Alteration of keratin plug dynamics (excessive removal leads to delayed sloughing and increased bacterial contact. Not removing enough may slow down keratin turnover rate).
- Enhanced openness of teat canal post-milking.
- Increased hyperkeratosis of teat-end.

Milking machine malfunctions most likely to result in new infections include: liner slips, rough cluster removal or kickoff during the end phase of milking causing a sudden inrush of air through the teat-cup. To a much lesser extent, vacuum fluctuations in the milk-line or receiver can contribute to

new infections. Inappropriate milking routine or over-milking may also increase the rate of new infections based on delayed milk letdown, teat end damage, etc.

SIGNALMENT

Potentially, all lactating ruminant species

PHYSICAL EXAMINATION FINDINGS

- Teat discoloration (congestion or cyanosis)
- Teat (base or end) swelling or hardness
- Teat orifice >2mm wide or deep
- Open teat lesions
- Vascular damage (petechiations on light colored teats)
- Rough (raised ring with 1-3mm old keratin) or very rough (>4mm old keratin) hyperkeratosis.

CAUSES AND RISK FACTORS

See above



DIAGNOSIS

DIFFERENTIAL DIAGNOSIS

Must rule out other causes of udder/teat lesions (trauma, Bovine Herpesvirus, frostbite, dermatitis, papillomavirus or pseudocowpox) as well as other causes of mastitis (i.e. gangrenous mastitis).

DIAGNOSTIC PROCEDURES

Teat condition of the herd should be evaluated by means of a scoring system (see Teat Club International Teat Condition portfolio, in references). Teat barrel and teat end abnormalities are described in Table 1 (below) as they relate to milking routine and equipment specifically.

Table 1 Teat condition parameters indicative of milking machine dysfunction (based on recommendation of Mein et al., 2001).

Condition	% of evaluated cows affected	Causes
Teat congestion or cyanosis	>20%	Over milking, heavy milking unit, high teat end vacuum, faulty pulsation, inappropriate liner size
Teat base swelling or hardness	>20%	High teat vacuum, wide bore liners, over milking

Teat end swelling or hardness	>20%	Over milking, wide bore liners, high teat end vacuum, pulsation failure, insufficient rest phase
Teat orifice >2 mm wide or deep	20%	High milking vacuum, over milking, heavy milking unit
Open teat lesions	>5%	Cold, wet, or windy weather, chemical irritation
Petechiations on light colored teats	>10%	Pulsation failure, high vacuum, over milking
Rough (raised ring with 1 to 3 mm old keratin) hyperkeratosis	>20%	Over milking, slow milking
Very rough (> 4 mm old keratin) hyperkeratosis	>10%	Over milking, slow milking

Setup and troubleshooting of milking equipment should be done by an expert (See NMC guidelines for equipment evaluation). A few basic guidelines include:

- Teat end vacuum: 11 to 12 inches Hg (37 to 41 kPa).
- Milk line vacuum: 14 to 15 inches Hg (47 to 51 kPa) (milk line above cows); 13.5 to 14.5 inches Hg (46 to 49 kPa) (center mount weigh jars); 12.5 to 13.5 inches Hg (42 to 46 kPa) (milk line below cows).
- Pulsator ratio: between 50:50 and 70:30
- Pulsator rate: 45-70 per minute
- Milking unit removal: milk flow <2.2 lbs./minute (1 kg/minute)
- Milking routine should be consistent and allow for 30 seconds of pre-dip contact time and 90-120 seconds of stimulation time.



MISCELLANEOUS

Stray Voltage

- Stray voltage is voltage present in the cow's environment that causes current to flow between two cow contact points (normally the milking parlor). It is usually caused by alternating current, although direct current has been implicated.
- Sources of stray voltage include off-farm causes (e.g., increased primary neutral current external to the farm such as 240V supplies) and on-farm causes (e.g., current imbalances and faulty or inadequate equipment grounding such as electrical fences and electrified crowd gates).
- Cows are affected when stray voltage is greater than 0.5V.
- Clinical signs include reluctance to enter the parlor, decreased milk production, increased milking time, unsettled behavior during milking, increased defecation and urination in the parlor and reluctance to drink water and/or eat if located in area of exposure.

If a stray voltage problem is suspected; contact the local electric power supplier. Part of the evaluation should be conducted during milking time when electrical demand is high.

- Cow contact voltages should be determined using a voltmeter with a 470-ohm resistor in series across cow contact points.
- New facilities should be evaluated for stray voltage.
- Although exposure to stray voltage appears to be a mild stressor to lactating dairy cows, it does not appear to contribute to increased SCC, increased mastitis or reduced milk yield.

Causes, prevention and correction of stray voltage are reviewed in more detail elsewhere.

ASSOCIATED CONDITIONS

Mastitis, teat end trauma, skin lesions

SEE ALSO

- Mastitis: Camelids
- Mastitis: Coliform
- Mastitis: Fungal
- Mastitis: Minor Bacteria
- Mastitis Mycoplasmal
- Mastitis: No Growth
- Mastitis: Small Ruminant
- Mastitis: Staphylococcal
- Mastitis: Streptococcal
- Teat Lacerations
- Teat Lesions

ABBREVIATIONS

- NI= New infections
- NMC= National Mastitis Council
- SCC= Somatic Cell Count

Suggested Reading

Mein, G.A. The role of the milking machine in mastitis control. In: Veterinary clinics of North America Food Animal Practice: Mastitis in dairy cows 2012; 28(2):307-320.

National Mastitis Council website. www.nmconline.org

Procedures for evaluating vacuum levels and air flow in milking systems. 2012. National Mastitis Council Milking Equipment Committee, National Mastitis Council, 421 S Nine Mound Rd., Verona, WI 53593.

Reinemann, D.J. Stray voltage and milk quality. In Veterinary clinics of North America Food Animal Practice: Mastitis in dairy cows 2012; 28(2): 321-345.

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