

## **EVALUATION OF BOVINE TEAT CONDITION IN COMMERCIAL DAIRY HERDS: 2. INFECTIOUS FACTORS AND INFECTIONS**

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### Introduction

Various agents and mechanisms, causing a number of forms of trauma or lesions, may affect the condition of the teats of the milking dairy cow. In general, these agents and mechanisms fall into one of three broad categories:

- Machine milking effects
- Environmental effects and/or agents
- Infectious agents

Table 1 details the conditions found in each category.

**Table 1 Teat conditions observable according to the cause of the problem.**

<b>Machine induced</b>	<b>Environmental</b>	<b>Infectious</b>
Discoloration	Chapping	Pseudocowpox
Oedema	Mud sores	Herpes mammillitis
Congestion	Suckling damage	Cowpox
Wedging	Fly bites	Papilloma
Ringling	Other abrasions and cuts	Foot and Mouth Disease
Hemorrhaging - petechia	Weather damage	Vesicular Stomatitis
Hemorrhaging - larger	Allergic reactions	Ringworm
[Hyperkeratosis]	Photosensitization	<i>Staphylococcus aureus</i>
	Chemical damage	<i>Streptococcus dysgalactiae</i>
		<i>Arcanobacterium pyogenes</i>
		<i>Fusiformis necrophorum</i>

Short-term effects and medium-term changes caused by machine milking have been described in a companion paper (Mein et al., these proceedings), similarly for the more chronic changes known as hyperkeratosis (Neijenhuis et al., these proceedings). On examination of teats many other conditions may be observed. The most frequent variation of the teat from perfect condition is the degree of roughness of teat skin. This is the simplest of a series of environmentally related conditions that are usually unconnected to the action of the milking machine but may be causally related to the milking process. These conditions will be described fully elsewhere but have been described briefly by Mein et al. (these proceedings).

A second group of skin conditions is caused by infections. Infectious lesions of teat skin are usually caused by viruses, pyogenic bacteria, necrotizing bacteria or fungi. Lesions may affect the epithelium of the teat orifice, the teat barrel and the udder skin. Viral infections usually cause primary lesions. Bacterial infections may cause primary lesions or be secondary infections of pre-existing viral lesions or trauma. The initial trauma may be

milking-machine induced damage or be caused by any of the environmental factors listed (Table 1).

Infectious lesions of teat skin can indicate the standard of the hygienic practices as well as mastitis prevention and milk quality management employed on the farm and may be used to indicate exposure to environmental conditions injurious to cow welfare. Any deterioration of teat skin condition may adversely influence milk quality, milk safety, and udder health and present hazards to the health and safety of staff.

### Infectious lesions

#### **Viruses**

Viral infections vary in the severity of the damage caused, in infectivity and in frequency of occurrence. Generally they are rare in developed dairy industries when good udder hygiene is applied, such that most are readily controlled by avoiding transmission from manual handling and by use of post milking teat disinfection.

#### **PSEUDOCOWPOX**

This is probably the most common viral infection of teats, causing lesions and cutaneous damage. The infection is caused by a member of the genus *Parapoxvirus*, a DNA virus closely related to orf which affects sheep.

The lesions are principally found on the teats although the mouth may also be affected. Calves suckling teats of infected cows may develop lesions of the mouth and muzzle. Color photographs of various stages of the development of the lesions and complications may be found in 'Bovine Medicine' (Andrews et al., 1992). On teats there is initially a small red papule surrounded by 0.5-1.0 cm of erythema. The centre may form a vesicle that ulcerates then scabs. Typically after 10-12 days the lesion heals outwards resulting in a characteristic ring or horseshoe-shaped scab. Some 5-10% of animals may be affected on the udder too. Recovery takes 3-5 weeks but immunity is low and re-infection is common. The infection is usually chronic and spreads slowly through the herd. Acute infections occur, most commonly in newly calved heifers and animals newly introduced to the herd. Acute infections result in difficulty in milking due to discomfort to the cow. Often milk-let down is impaired.

The virus can also infect the hands of the milker resulting in a condition known as 'milkers nodules, where purple nodules appear on fingers. The lesions may break down, crust and then heal without scarring. This condition is relapsing and so there may be continual cycles of infection between cows or between the milker and the cows.

Diagnosis is based on the characteristic lesions on the teats of cows or the hands of the milkers. The virus can be readily identified and differentiated by laboratory tests.

#### **HERPES MAMMILLITIS**

Both herpes type II and herpes type IV viruses cause bovine herpes mammillitis (BHM) teat lesions. The lesions are clinically and epidemiologically similar but can be distinguished by serology. Outbreaks of BHM can make milking very difficult and are often accompanied by concurrent mastitis. The virus can survive in the environment for at least 100 days at room temperature and survives freezing and thawing.

The response to infection is highly variable, from animals that simply sero-convert with no lesions, through mild lesions that heal to severe erosive lesions. The latter are slow to heal

and the deep ulceration is often secondarily infected. Initially there is a painful swelling of the teat and reddening of the teat skin. Teats then develop multiple raised oedematous plaques followed by formation of irregularly shaped vesicles. The vesicles rupture within 24 hours, probably aided by the milking process, leaving an ulcerated surface that exudes copious serum and virus. On drying, a thick dark-red scab forms, distinguishable from the ring shaped lesions of pseudocowpox. Lesions may coalesce to affect most of the teat skin and often much of the udder skin. The extent of the ulceration and scab formation is indicative of herpes infection. Color photographs of various stages of the development of the lesions and complications may be found in 'Bovine Medicine' (Andrews et al., 1992). Secondary bacterial infection, leading to sloughing of teat skin, is a common consequence. Lesions typically heal in 2 to 3 weeks but some ulcerated lesions may persist for months. Lesions occurring on the udder tend to be more diffuse and superficial. Once the lesions have healed there is evidence of long term immunity to the disease.

Herpes infections show a seasonal pattern although this may be a weather or climate association. They appear more commonly in April and November in the mid-USA and from late summer in the UK. Insect transmission has been suggested but not proven. Newly calved heifers, some 2-3 weeks post partum, are usually the most severely affected suggesting contagious spread at milking or that the stresses associated with the first calving affect the likelihood of disease occurring. Very young animals may sero convert. Like all herpes infections, the virus remains latent and lesions may recur.

#### PAPILLOMA

Bovine papilloma viruses cause papillomatosis or warts on teats. Supposedly up to six separate strains of papilloma virus occur with at least two identified as the cause of warts on teats.

Warts are most common on young cows although they are contagious. The most obvious and problematic warts are those that are frond-like or filamentous protruding up to 10 mm. In some newly calved heifers in some herds warts may completely obscure the teats. The warts are of most nuisance if found on the teat duct orifice affecting hygiene and milk flow. They are easily damaged and bleed, occasionally profusely. They may be secondarily infected although a direct association with mastitis is not proven. Many frond warts resolve over the first lactation, although some are persistent and may need to be removed surgically.

Many teats and herds only show 'rice grain' or small, smooth and flat, white warts anywhere on the teat. These warts are rarely of any problem to milking or mastitis.

#### COWPOX

Infections by this orthopoxvirus were rare, of little strategic importance and were confined to Europe. Since the eradication of smallpox and the discontinuation of human vaccination it is unlikely that vaccinia infections of teats will occur naturally. However, with any spread of vaccinia recombinant vaccines then a resurgence is possible.

The lesions develop as an erythema, forming a pustule that ruptures and then suppurates. Healing is centripetal and uncomplicated, taking up to three weeks. Life-long immunity occurs.

#### FOOT AND MOUTH DISEASE (FMD)

There is a need to differentiate Foot and Mouth Disease from more common viral teat infections as occasionally pustular lesions occur on teats before their appearance in the mouth. However, the rapid development of other clinical signs including profuse salivation, nasal discharge, recumbency or foot stamping will quickly lead to a more correct diagnosis. Confirmation by identification of the antigen or antibodies is essential.

#### VESICULAR STOMATITIS

This infection appears restricted to the Americas where it is transmitted by biting insects although direct transmission also occurs. Epizootics have been described every 5-10 years.

The severity of the disease is variable but clinical signs closely resemble those of Foot and Mouth Disease. Lesions, however, usually develop on one site only of the mouth, the feet or the teats although there is excessive salivation. Laboratory confirmation of virus is essential to distinguish the infection from FMD.

#### **Fungi**

##### RINGWORM

The infection of skin keratin by the fungus *Trichophyton verrucosum* occasionally spreads to the teat. The condition is very unlikely to be confined to the teats and udder and should be easily recognised from the characteristic grey-white and ash-like skin encrustation usually on the thorax and limbs of adult cows.

The infection is highly contagious and likely to spread to milking staff. Usually herd immunity develops but reoccurrence is typical when new susceptible animals are introduced, especially as spores survive in buildings for several years.

#### **Bacteria**

Bacterial infections of teat skin are significantly more prevalent than any viral infections, and of much more importance to dairy economics as a major source of new intra mammary infections and clinical mastitis, both in lactating and non-lactating cows. Untreated teat lesions are rapidly colonized by any, or all, of various bacteria.

*Staphylococcus aureus*, *Streptococcus dysgalactiae* and *Arcanobacterium pyogenes* are ubiquitous on the skin of dairy cows. They readily colonize any lesion, traumatic or infectious. Infections of the teat skin have been shown to be a major risk factor for mastitis in dairy cows. The requirement to disinfect all teats of all cows after every milking, as part of mastitis control, is directed at reducing the exposure of the mammary gland to these organisms and to expedite the most rapid healing of all lesions.

It was shown clearly some 30 years ago that chapped teats were highly likely to be infected with *Staphylococcus aureus* or *Streptococcus dysgalactiae*, and that such infections were closely associated with high new infection rates and frequent cases of clinical mastitis (Kingwill et al., 1970). The disinfectants developed for teat treatment are usually effective at eliminating bacteria and viruses from lesions and usually contain emollients to promote skin healing.

Primary bacterial infections of skin are likely to be purulent, presenting as discrete pustules or as impetigo. They may frequently be necrotizing, especially when *S. aureus* is involved.

One particularly important bacterial infection is colonization of the damaged teat orifice, often created by poor machine milking, by *Fusiformis necrophorum*. The condition, known as 'blackspot', is easily recognizable from the color of the scab formed (a color photograph may be found in 'Bovine Medicine' (Andrews et al., 1992). This anaerobic bacterium is highly necrotizing and erodes the orifice. The teat orifice may become occluded leading to incomplete and very slow milking. Blackspot is a major risk factor to intra mammary infection by other bacteria.

More complicated lesions result from secondary bacterial infections causing significant changes in the appearance of the primary lesions making diagnosis difficult.

### Scoring infections

When assessing teat condition, all lesions and infections observed should be recorded. Few lesions and no infections should be found if good husbandry is being applied. Indeed identification of any infectious lesions is unlikely in routine teat condition monitoring in developed dairy industries, unless they have occurred as a consequence of traumatic teat injury such as a cut or a tramp. It is more likely that problems will be encountered when investigating problem herds with either poor milking performance, a mastitis problem or a reported teat condition problem of any form.

It is to be expected that no viral infections will be found in the vast majority of dairy herds to be investigated.

Bacterial infections are difficult to diagnose from clinical signs unless they are chronic secondary infections. Again they are symptomatic of poor husbandry. If any lesions caused by milking or environmental exposure have progressed to become severe or chronic then management is at fault and this is not a new occurrence on the farm.

The occurrence of any infectious lesions and making a correct identification should never be underestimated. A specific diagnosis is essential to indicate the strategic significance of the problem (especially for FMD), to identify the risk for the rest of the herd and the farm staff, and to design a treatment program to alleviate the condition and remove the causes. When lesions appear severe or affect more than a few teats then remedial action is necessary and the supervising consulting veterinarian should be consulted.

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