

Cattle lameness – Digital dermatitis prevention and control in the face of reservoirs and chronic DD lesions

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Abstract

Digital dermatitis (DD) or hairy heel warts is the most important infectious claw disease associated with lameness in dairy and beef cattle. This disease has appeared worldwide and has affected dairy cattle of all ages as early as 3 months of age, but mostly around breeding age and again during lactation around 21 to 120 days in milk (DIM). This seminar is aimed at emphasizing how chronically affected dairy cows with a history of DD before first calving will increase infectious pressure upon the lactating herd, and that early detection efforts, topical treatment, and disinfecting hoof baths should be customized to the dynamics of DD on-farm. The so-called 'Manageable State of Disease' where DD is under control, but still present, in a group of cattle, can be reached by systematic prevention and control of DD in the pre-calving heifers combined with risk factor management in addition to customized prevention and control of DD in the lactating herd. Veterinarians, hoof trimmers, and herd managers are part of exacerbating DD outbreaks and chronicity of DD lesions when too caustic or too frequent prevention and control measures are implemented. We are part of the problem! This presentation will explain why.

Key words: digital dermatitis, cattle, dairy cows, lameness

Introduction

Prevention and control of digital dermatitis (DD) in the face of chronically affected cows is a process of increasing awareness about chronic DD, the true enemy to efficient DD control. Digital dermatitis (DD, syn. hairy heel warts) is an infectious claw disease causing severe lameness in the cattle industry. The disease is characterized by circumscribed ulcerated and often proliferative lesions typically located on the plantar aspect of the hoof along the coronary band. Digital dermatitis presents in a cycle of 'M-stages' shown in Figure 1.^{1,2} The consequences of DD are decreased animal wellbeing and economic loss due to lameness, reduced milk production, decreased reproductive performance, and premature culling.

Research has shown that DD is a multifactorial, polymicrobial disease with an essential bacterial component among which are spirochetes, particularly treponemes. The interaction of the causative agents and risk factors, including the host, spirochetes, and an unhygienic environment are thought to result in outbreaks of DD lesions and consequently lameness. Treatment and control methods for DD include

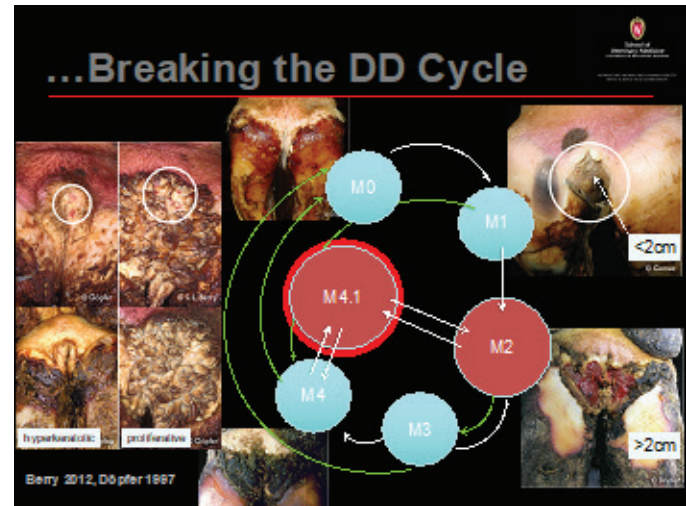


Figure 1. Cycle of 5 M-stages for digital dermatitis

individual, topical therapeutic interventions in cattle with severe, advanced lesions (topical treatment) and herd-based prevention strategies (foot baths) designed to minimize the progression of the lesions to advanced stages of DD. Many of the treatment and disinfecting agents, such as copper sulfate and formalin, used to treat or prevent DD, are problematic to the environment and human health. Therefore, the search for alternative preventative measures to disinfectants and antibiotics is ongoing.

Repeated episodes of 'M2' lesions, >2 cm in diameter, can result in proliferation of the epithelium representing a reservoir of infection, in mechanic horn damage, heel horn erosion, overgrown heel horn height and in the long-term in sole ulcers, wall abscesses, axial wall fissures, and severe longstanding lameness. It is crucial to correct the reversible horn damage associated with DD and to prevent microdamage to the interdigital skin by leaving sufficient heel horn height, and for this end, good collaboration with well-trained hoof trimmers is essential. First-lactation heifers with a history of DD during their pre-calving life are likely to remain open an average of 21 days longer, open and have significantly decreased milk production during their first lactation.³ We have not even begun to truly estimate the economic losses of DD, particularly in the face of chronic DD. Based on the recurrence of M2 lesions, cows are classified into 3 categories: Cow Type I, II, and III as shown in Table 2. The group dynamics at the population, farm or group level are typed into 3 categories as well, as shown in Table 3.

Table 1. Five M-stages for the clinical stages of DD are:^{1,2}

- **M0:** normal skin appearance
- **M1:** small focal circumscribed damage of the epithelium at the skin horn border, <2.0 cm in diameter
- **M2:** circumscribed ulcerative skin defect, a red or grayish surface that can have a white epithelial margin, overlong hair and can be painful to the touch, >2.0 cm in diameter
- **M3:** the healing stage of DD, after the M2 lesion has covered itself with a scab that is not painful to the touch
- **M4:** chronic stage of DD that is characterized by a thickened epithelium (hyperkeratosis) or proliferative growth of the epithelium (heel warts)
- **M4.1:** the chronic stage as described under M4, but with an M1 lesion within its perimeter

Please note that we record the M-stages associated with hyperkeratosis or proliferation as for example M2P, M4H, and M4P.

Table 2. Based on the recurrence of M2 lesions, cows are typed into:⁴

- **Cow Type I:** cows that never develop M2 stages
- **Cow Type II:** cows that develop M2 stages once and never again for prolonged periods of time
- **Cow Type III:** cows that develop M2 stages repeatedly, for example every 14 days (known as the core group of “problem cows”)

Table 3. Based on the recurrence of outbreaks of M2 lesions, farms and groups of cows are typed into:

- **Farm Type I:** no outbreaks of DD
- **Farm Type II:** outbreaks of DD occur once and never again for prolonged periods of time
- **Farm Type III:** repeated, periodic outbreaks of DD, sometimes over years, the so-called “problem farms”

The idea that the dynamics of digital dermatitis (DD) are not governed by active lesions alone, but predominantly by chronically affected cows with repeated DD lesions and signs of chronicity such as hyperkeratosis and proliferation of the epithelium, needs to be emphasized. ‘Not all M2 lesions are equal’ because of the associated signs of chronicity, and therefore the lesions will react differently to topical treatment, often resulting in failure of treatments (Figure 2). The best one can expect from the topical treatment of a Cow Type III or Cow Type II is to result in a stage of DD that can go through a disinfecting foot bath. It needs to be emphasized that disinfecting foot baths are meant to prevent, not to treat DD lesions. Therefore, it is not good practice to walk ulcer-

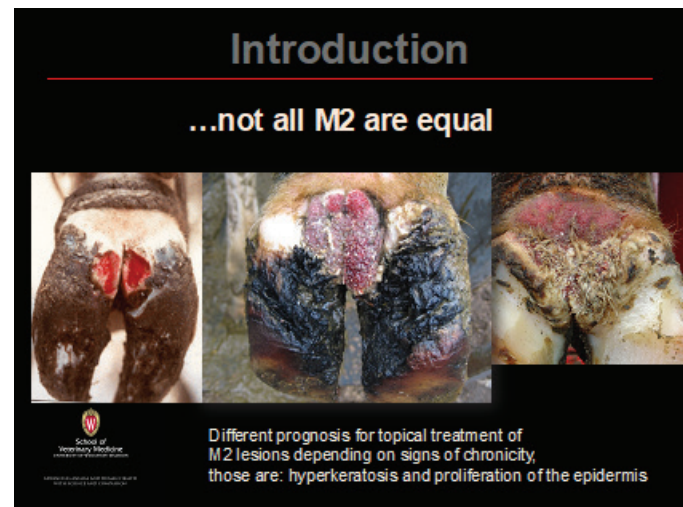


Figure 2. Not all M2 lesions are equal; the M2 lesion on the lefthand side is a first episode of DD in a heifer and prognosis for topical treatment is relatively good. The M2 lesions in the middle and on the righthand side are M2P lesions, meaning that proliferative epithelium surrounds the ulcerative M2 lesions, resulting in a very bad prognosis for effect of topical treatment.

ative DD lesions, i.e., M2 lesions, through a disinfecting foot bath. The M2 lesions need to be detected early and treated topically according to a standardized protocol before going through a foot bath. In addition, when we lift a cow’s foot for topical treatment of an ulcerative DD lesion, we are way too late, because the strictly anaerobic treponemes associated with the pathogenesis of DD have descended deep down into the dermis and are unreachable for topical treatment applied to the skin surface.

This directs the emphasis for prevention and control of M2 lesions onto risk factor management, early detection, and prompt topical treatment using a non-antimicrobial treatment agent such as chelated copper gels. Secondly, the increase in numbers of M4 lesions combined with proliferations (M4P) is a sign for the necessity to customize the prevention and control systems implemented on-farm, because detection of M2 lesions may be delayed, topical treatment agents and disinfecting foot bathing agents may be too concentrated or applied too frequently, or both. The first sign of an efficient prevention system applying customized foot baths in well-designed foot bathing troughs is the ‘falling flaps’ of proliferative tissues from the M4P lesions, resulting in M4H stages of DD. Figure 3 illustrates the ‘falling flaps’ after a customized footbathing strategy was installed on a Farm Type III.

The seminar described the farm type dynamics in relation to prevention and control of DD in different age groups of dairy cows. Figure 4 summarizes the farm dynamics and the 3 stars point at critical points in time when decisions about population-level interventions are made. It can be seen that on Farm Types I, no outbreaks of DD occur, but

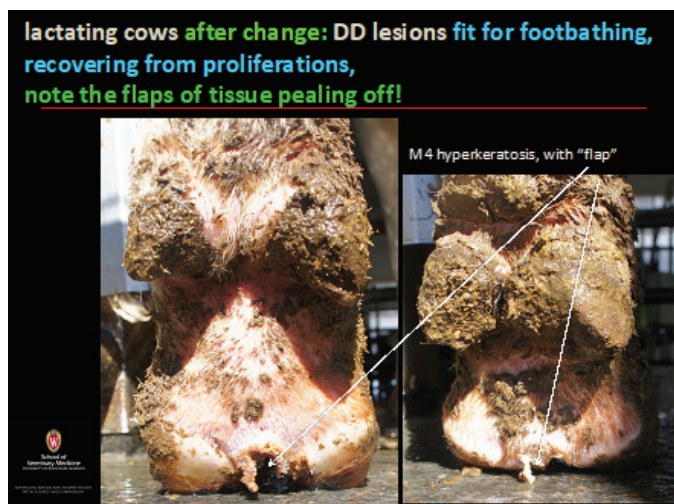


Figure 3. The ‘falling flaps’ of proliferative tissue 3 to 6 weeks after implementing a customized footbathing strategy on a Farm Type III together with a standardized topical treatment protocol.

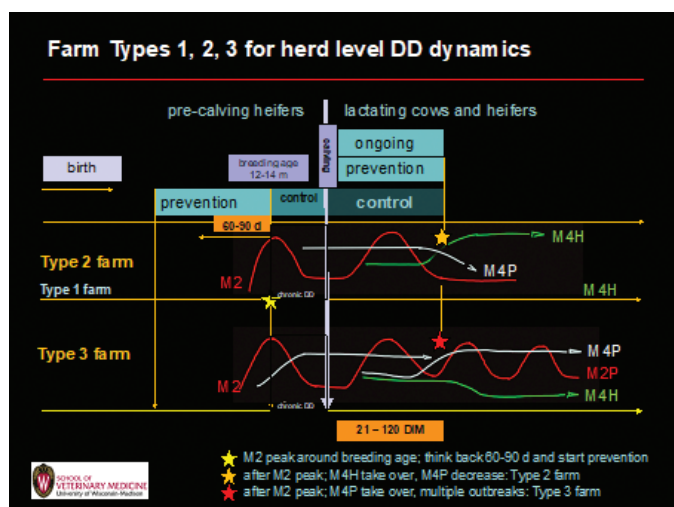


Figure 4. Farm type dynamics of DD over time across different age groups of dairy cows.

occasional, often unnoticed, M2 lesions, alternate with ~10 to 30% of cows affected by M4H lesions. On farms like this, more sustainable foot bathing agents can keep DD under control. On Farm Types II and III, the pre-calving heifers often have a peak of numbers of M2 lesions around breeding age (12 to 14 m of age) followed by chronic DD lesions, such as M4P and M4H. The yellow star in Figure 4 marks the point in time when the peak of M2 lesions is found in the pre-calving heifers. One should calculate 60 to 90 days back in time and start prevention and control measures at that time.

After calving and introduction of heifers into the lactating herd, a new peak of M2 lesions can occur between 21 and 120 DIM, increasing the infectious pressure on the other lactating cows and provoking large outbreaks. The difference

between Farm Type II and III is that on the Farm Type II, the outbreaks are singular as marked by a rise in M4H lesions after the outbreaks; those are lesions that will most likely remain in place for the rest of the life of the cows. The orange star in Figure 4 marks the point in time when this phenomenon can be seen on the Farms of Type II.

On Farm Type III, the outbreaks of M2 lesions are periodic and repetitive in nature, and M2 lesions alternate with M4P lesions that increase in numbers over time while the numbers of M4H lesions decrease. The red star in Figure 4 indicates the moment when the rise in M4P is noticeable and should trigger the revision of the prevention and control system to become customized to the DD dynamics on a particular farm. DD prevention and control is NOT a ‘one-size-fits-all’ business, because lower concentrations of disinfectants, lower frequencies of foot bathing episodes, and a pH of the copper sulfate foot bathing fluids of 3-5 can become useful and functional for preventing DD. DD penwalks recording M-stages and their signs of chronicity, for example using the DD Check App,⁵ can be used to assess the dynamics of the M-stages and the effect of customized foot baths, prevention, and control. Standardized topical treatment protocols become most efficient when detection of M2 lesions occurs early in the process and treatment is issued promptly. A caustic topical treatment agent is not good practice and should be avoided.

Conclusions

Prevention and control of DD in pre-calving heifers is essential for achieving the so-called ‘Manageable State of Disease’ concerning DD. Herdsmen, hoof trimmers, and veterinarians need to collaborate in order to design a prevention and control system that is customized to the population dynamics of DD. Once the Manageable State of DD is reached, once the ‘flaps have fallen’, and the number of M4P lesions has decreased, sustainable alternative foot bathing agents such as, for example, 1% chlorine solutions, can be used to swap out copper sulfate and formalin while maintaining good DD control. This is a long-term effort that pays off in the long run.

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