Digital Dermatitis in Dairy Cattle Is Still a Serious Problem in Western Europe

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Abstract: Bacterial infections are quite common in dairy cattle, and frequently related to internal organ systems like e.g. respiratory, intestinal and udder infections. Lameness in dairy cattle is mainly caused by both infectious and non-infectious hoof problems and these have different etiological background. At the moment (2018) the major infectious hoof disorders are DD (Digital Dermatitis) and IP (Interdigital Phlegmon). These are all due to infection from the area where dairy cows normally live and more or less intensive contact with “contaminated” manure. This paper gives insight in these different dermatitis problems cows are daily confronted with, with a focus on infectious hoof disorders as a more or less permanent problem in today’s dairy farming.

Key words: Dairy cattle, dermatitis, lameness, claw disorders, digital dermatitis, interdigital phlegmon, white line disorders.

1. Introduction

Dermatitis in cattle is caused by different pathogens, which can be distinguished into parasitological, viral and bacterial pathogens. Some main pathogens are:

1.1 Parasitological

• *Psoroptes ovis*, a frequently seen problem, is limited possibilities for good treatment and it is a major problem in the beef cattle industry, especially in Belgian Blue cattle [1].

• *Ixodes ricinus*, related to special area’s and habitats, causes problems all over the world with piroplasms, which include Babesia and Theileria, mainly *B. divergens* that has an economic interest in Europe. This may cause acute haemolytic anaemia [2].

• Mycosis, most inflammatory skin and hair dermatophytosis are caused by zoophilic dermatophyte species. *Trichophyton verrucosum* is most important and zoonotic [3] as also *Microsporum canis* (from cats and dogs) [4].

1.2 Viruses

• Viral infections like foot and mouth disease virus, malignant catarrhal fever (ovine herpes virus type 2) [5, 6], may cause both damage to the internal organ systems and some serious dermatitis problems also. Related to the number of viruses causing dermatitis problems, this needs to be discussed in another contribution.

1.3 Bacterial

• UCD (Udder Cleft Dermatitis), most probably caused by *Treponema* spp. UCD is an inflammatory skin condition affecting the anterior parts of the udder of dairy cows. The lesions may present as mild or severe skin lesions and have been associated with mastitis and DD (Digital Dermatitis). The full aetiology and pathogenesis is not completely understood [5].

• *Dermatophilus congolense*, causes pustular dermatitis related to unhygienic circumstances or rain, zoonosis [7].

• Folliculitis is caused by *Staphylococci* spp., as a consequence of poor hygiene. In cattle, staphylococcal infections may present as folliculitis or as impetigo. Both may present as mild forms of a group of
conditions loosely termed udder dermatitis, which has various clinical presentations and does not always involve staphylococci [8].

- ICDs (Infectious Claw Disorders) are present in almost all herds, all over the world. Even in an area like New Zealand where dairy is pastured permanently the whole year, ICDs are found [9]. In a follow-up study, the influence of claw trimming in the introduction and transmission was confirmed [10].

The most important presentations of dermatitis of the under feet are presented here, with a herd prevalence of all of these of > 95%. The cow prevalence in Western dairy herds at the moment of regular claw trimming is:

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Prevalence</th>
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<tbody>
<tr>
<td>DD</td>
<td>22%-24%</td>
</tr>
<tr>
<td>IP (Interdigital phlegmon)</td>
<td>0.6%*</td>
</tr>
<tr>
<td>IDHE (Interdigital Dermatitis/Heel Horn Erosion)</td>
<td>30%-40%</td>
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*IP is most time not diagnosed during regular claw trimming, but recognized and treated promptly by dairy farmers at the onset.

Infectious hoof disorders are mainly important bacterial dermatitis problems related to economic consequences and affecting animal welfare. The objective of this paper will give you more insight in the current prevalence of dermatitis of the under feet in our country and also the most important risk factors and current insights in therapy and prevention (generally known and more recent insights) will be discussed.

2. Materials and Methods

2.1 Data and Case Definition

In The Netherlands dairy cattle is trimmed twice a year by trained professional claw trimmers, who made recordings about the presence or absence of 7 claw disorders of hind claws. In the year 2018 information was collected of 11,130 cows in 105 dairy herds at the time of regular claw trimming of all the dairy cows in a herd. Eighteen claw trimmers were selected from two private organisations of professional claw trimmers. They had to record claw disorders of all eligible milking cows and sometimes pre-partum heifers (if already in the milking herd to become “acclimated”) at the end of their pregnancy in the herd during trimming. Registered were the ICDs: DD, ID/HHE, IP and the non-infectious disorders: SH (Sole Haemorrhage), SU (Sole Ulcer), IH (Interdigital Hyperplasia) and toe necrosis. Information was collected at hind-leg level and presence of a disorder was reported if the lesion was present in at least one hind leg/claw. Recordings were performed based on visual inspection (DD, IDHE, SH, SU, IH), hardness of the horn (SH, SU), smell (IDHE) and pain reactions of the cows (DD, WLD (White-Line Disorder), SU) and based on the international standardized diagnoses as described in the handbook of ICAR Atlas of Claw Health. Recordings were presented as 0 or 1 (absent vs. present), except for the diagnosis SH, SU, WLD, DD and IDHE; these diagnoses were scored in ordinal numbers (0, 1, 2, 3). For SH for example, the diagnosis on the definitions as supposed by Bergsten [11], 0: no signs, 1: mild (single haemorrhagic spot or superficial haemorrhages of a small area, and/or yellowish discoloration); 2: moderate (moderate haemorrhage on a single spot or superficial haemorrhages of several spots or a large area of the sole (> 20%)); 3: severe (profound haemorrhage (extending into the corium) on a single spot or extreme haemorrhagic discoloration of the sole (> 50%).

Claw trimmers were trained in diagnosing claw disorders; before the data collection, the definition of the disorders was discussed by photographs with the first author as facilitator and diagnosis of the claw trimmers was compared with the diagnosis of the author at least once during hoof trimming on location.

2.2 Selection of Herds

Claw trimmers were requested to select herds where trimming was done on a regular basis and regardless of previous trimming results. Participation was agreed
on by the farmer, so farmers could choose not to participate. Herds could participate only once in the study. Ninety percent of the selected herds agreed to participate. The reasons for refusals were: time consuming, absence of (financial) compensation, not being convinced about the advantages of the recordings, not willing to cooperate for unclear reasons.

2.3 Statistical Analysis

The prevalence was estimated by the number of cows with a score $\geq 1$, divided by the total number of cows with a score.

3. Results and Discussion

3.1 Results

Observed herd and within herd prevalence for the 7 different claw disorders are given in Table 1.

The average number of cows trimmed per herd was 83.7 (SD: 30.7, median: 83.4, range: 35-192). Each claw trimmer recorded the results of a median of 6 herds. As stated before IP was most times not recorded during regular claw-trimming meetings, but diagnosed by the farmers themselves in cooperation with their practitioners. Based on the monitoring function of Royal GD Deventer, it is quite clear that an increased number of herds were noticed with a high percentage of hard treatable cows with IP. Some herds had the cull and/or euthanise about 15%-20% of their dairy cattle for that reason.

3.2 Discussion

Related to previous investigations the percentage DD, TN and HYP are more or less the same as early years of 21th century, IDHE and SH enormously decreased and SU and WLD increased [12]. This resulted in hardly no decrease in lameness prevalence, despite research over the last 50 years. We have no good insight into the implementation by the farmers and so the practitioners and other advisors should think about the correct way of communication [13].

3.2.1 Representativeness of the Data

Based on information of the Dutch board of claw trimmers and the commercial farm-supporting organisations, there are about 120 private claw trimmers and 230 trimmers working for organisations that employed claw trimmers. The claw trimmers involved in this study were proposed by their employer as being representative for all their employees and they performed claw trimming for almost 100% of their professional activities. The herds in this study were mainly located in the Northern and Eastern part of The Netherlands. There was no other general information about the background of the herds normally trimmed by the claw trimmers, than cows were offered only because of systematically preventive trimming. However, there was no reason to believe that these herds were different from a cross-section of all Dutch dairy herds, because of e.g. the average herd size in this study (106.0 cow/milking herd) which was comparable with the average herd size in the Netherlands 104.6 cow/milking herd; GD monitoring info). In addition, the percentage of herds with all year housed cows (25%) and herds with slatted floors (89%) was not different for herds in this study compared to the total Dutch dairy-herd population [14].

Table 1 Observed herd and within herd prevalence (%) of 6 claw disorders as recorded as recorded by 20 claw trimmers (105 herds and 11,130 dairy cows (3,339 heifers and 7,791 cattle in $\geq$ 2nd lactation)). Interdigital hyperplasia (IH).

<table>
<thead>
<tr>
<th></th>
<th>DD</th>
<th>IDHE</th>
<th>SH</th>
<th>SU</th>
<th>WLD</th>
<th>TN</th>
<th>HYP</th>
</tr>
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<tbody>
<tr>
<td>Herd prevalence</td>
<td>91.6</td>
<td>95.4</td>
<td>97.8</td>
<td>85.7</td>
<td>89.2</td>
<td>78.0</td>
<td>80.6</td>
</tr>
<tr>
<td>Within herd prevalence</td>
<td>Heifers</td>
<td>22.9</td>
<td>6.0</td>
<td>14.3</td>
<td>3.3</td>
<td>10.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Cattle $\geq$ 2nd lactation</td>
<td>21.0</td>
<td>10.1</td>
<td>14.5</td>
<td>9.5</td>
<td>17.9</td>
<td>3.5</td>
<td>8.6</td>
</tr>
<tr>
<td>Average</td>
<td>21.6</td>
<td>8.2</td>
<td>14.5</td>
<td>6.5</td>
<td>14.4</td>
<td>2.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>
3.2.2 Importance of the Dermatitis of the Under-Feet

3.2.2.1 Why Is That Important?

Similarity between the different ICDs is that they all started with affection of the skin of the under-feet, whereby DD is caused by a combination of different Treponema species, like *Treponema pedis*, *T. phagedenis* and *T. medium* [15]. The presence of one or any combination of these three species, sometimes also seen in combination with other bacteria spp. is associated with clinical symptoms of DD as documented by several PCR (Polymerase Chain Reaction)-based investigations [16]. IP is a phlegmonous inflammation of the tissue caused by different bacteria like *Fusobacterium necrophorum*, as the most important and *Dichelobacter nodosus, Porphyromonas levii, Prevotella melaninogenica, Treponema* spp. and *Trueperella pyogenes* as pathogens that play a role also [17], while ID/HHE is thought to be a consequence of mainly *Dichelobacter nodosus* [18]. The importance of DD and IP is that these are very painful and so it has all kinds of consequences like reduced feed intake (production and fertility), affection of animal welfare and reduced durability [19]. So it harms the animal, the farmer, the sector and the society as a whole.

3.2.2.2 Differentiation of the Different Causes

Distinguish of the different ICDs is possible by the clinical presentation, but the leg has to lifted in a trimming chute, although a trained person can distinguish between IP and DD in a parlour [20]. Above that DD and IP are seen more in young cattle and in earlier stages of lactation, while ID/HHE is seen in higher parities and later stage of lactation stage [17, 21].

The presentation of DD is very typical during the acute stage with a strawberry like surface, a typical border with long hairs and the lesions are painful upon touch. The chronic stages vary in presentation but normally have a crust and are not painful upon touch [21]. Lesions are most commonly seen at the skin-horn border on the plantar aspect of the interdigital cleft of the hind limbs and most times diagnosed well [22].

IP is typically an infection of hind feet of young cattle, causing fever and acute serious lameness with symmetric swelling above the coronary band. The lesions are often recognized immediately by the herdsman and promptly treated [17]. For unclear reason the sensitivity of IP for traditional chemotherapeutics, results even in an increased number of involuntarily culling and/or euthanasia (personal experience). New research must give insight in the background of this problem.

ID/HHE starts as DD most times as a dermatitis on the plantar aspect of the interdigital cleft of the hind limbs and is recognized by a very typical smell. Inflammation is confined to the epidermis. Diffuse epidermal erosion and hyperkeratosis creates a roughened appearance to the interdigital skin and dorsal and plantar commissural skin folds [23].

3.2.2.3 Diagnostics Tools

Diagnosis in case of hoof disorders is most times made by the claw trimmer at the moment of regular preventive performance. Diagnostic tools are besides general investigation of the cow, visual inspection of the leg, smell and pain reaction upon touch with limitations [18]. In a recent publication variation in outcomes of these forms of diagnosis has been evaluated by an inter-observer agreement test and showed some stages of active DD lesions only a substantial agreement.

Other diagnostic tools are based on antibody responses to causing organisms at herd level, which means bulk milk investigation [24-26]. Nowadays GD-Animal Health offers an in-house bulk-milk test to evaluate the antibody response against the major DD causing *Treponema* bacteria and the outcome is correlated with the clinical activity of DD (in control, chronic or mainly active DD). These tools support to
monitor DD at herd level and to make the right management decision: individual treatment of painful active lesions or preventive measures to reduce the transmission from absence or (non-painful) chronic stages to painful active lesions. Frequent transitions of individual cows to active lesions should result in premature culling to reduce infection pressure at herd level [27].

3.2.2.4 Therapy and Prevention

The therapy for all these disorders is different and depends on the diagnosis. Active DD lesions need to be treated by topical application of an antibiotic spray (tetracycline or thiamphenicol) or zinc-copper chelate unguents [28, 29]. Application under bandage results in significant better healing [30]. In some studies successful application of salicylic acid is mentioned, but these have not an official registration. Another real problem here is the high rate of recrudescence, due to intra- and sub-epidermal hiding of the causing organisms.

IP is good treatable by parenteral antibiotics (e.g. penicillin or oxytetracycline) and an infection gives lifelong immunity [31]. In a Swedish study satisfactory treatment result after treatment by salicylic acid was noticed, when possible at a very early stage. Within 3-5 days, treated cows responded with reduced lameness, lower body temperature, decreased coronary swelling, and an improved general condition compared to the day when the treatment started. Salicylic acid therefore proved to be an alternative in the treatment of early-detected non-complicated IP [32].

The therapy of ID-HHE is a combination of good claw trimming with topical application of antibiotic spray.

The preventive measures are for all hoof disorders more or less the same and comprised good hygienic (housing) circumstances, dry floors, preventive hoof trimming, pasturing, hoof disinfection on a regularly base, good nutrition for good immunity responses and prevention of thin manure, culling of permanently reactivating cows with DD, prevention of infection of young stock and others.

4. Conclusions

Dermatitis in cattle is absolute more than a digital problem, but bacterial infections in the digital region are the most prevalent. Therewith, infectious hoof disorders are a major dermatitis problem in today’s dairy farming, but application of good hygienic and other measures in time, must support the farmer. Limitation of (infectious) hoof disorders contributes to better economic results, better welfare and sustainability of the dairy cows and more job satisfaction for the farmer and the advisors.

References

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