

STAMPING OUT DIGITAL DERMATITIS

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Digital dermatitis (DD) is a highly infectious cause of lameness in cattle and, since its discovery in 1974, it has spread rapidly worldwide. It is a common problem for many dairy herds and even if it isn't at the forefront of a lameness problem on farm, it is often lurking in the background. As well as being a welfare concern, it also impacts on herd performance as a result of reduced milk yields, infertility (Argaez-Rodriguez *et al.*, 1997; Relun *et al.*, 2013; Gomez *et al.*, 2015a) and an increased susceptibility to other causes of lameness (Gomez *et al.*, 2015b).

WHERE DO THE DD BACTERIA LIVE?

It has long been thought that slurry is the main long-term DD reservoir on a farm, however, this isn't the case. The spirochaete bacteria that cause DD are very active and motile and therefore slurry provides them with the perfect way to spread, however, they only survive in slurry for a relatively short period of time (<24 hours at 17°C). Therefore, rather than being a long-term reservoir of infection, slurry acts mainly as an effective short-term transmission medium. Instead, it is the DD lesions themselves that are the main reservoir of infection, shedding treponemes into the environment and increasing the risk to uninfected cows. This is important to consider when it comes to implementing control strategies on farm.

WHAT DOES IT LOOK LIKE?

Lesions mostly occur on the skin between the heels on the rear hooves or on within the interdigital cleft. Occasionally lesions can be found adjacent to the accessory digits or on the front of the foot in between the claws. DD has also been found to infect claw horn lesions such as white line disease, sole ulcers and toe ulcers. DD is primarily thought of as active red, raw, ulcerative lesion, however there are many different stages to DD infections and even within these stages the lesions can vary in their appearance. These stages can be thought of as a 'DD Cycle of Infection' (Figure 1) and understanding the cycle is key to gaining control.

Uninfected/M0: Normal healthy skin with a smooth interdigital cleft with no signs of infection.

Early Active/M1: Lesions are <2cm in diameter and red or greyish in colour. They are usually not painful when touched (Figure 2).

Active/M2: Classical ulcerative stage with a lesion >2cm in diameter and typically circular or oval in shape. At an early stage of development (<5 days), hair will usually still be present in the lesion (Figure 3). If these lesions are not successfully treated with topical antibiotics at an early stage when the treponemes are still present on the surface of the skin, they will start to move deeper and encyst resulting in proliferation at which point the lesion becomes raised and 'strawberry-like' in appearance (Figure 4).

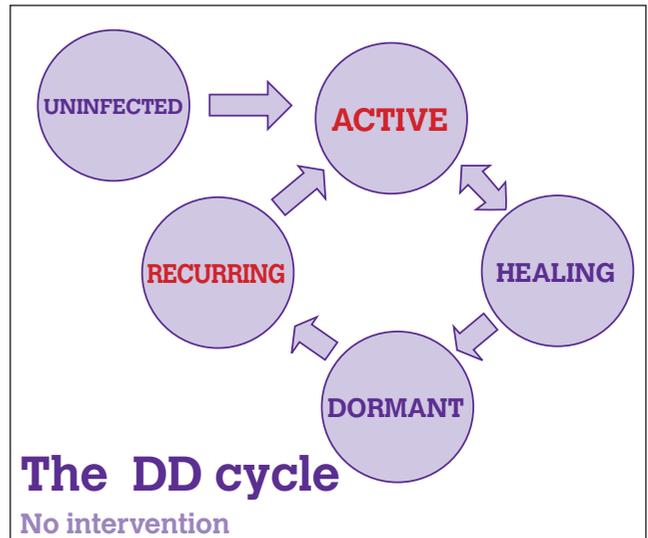


Figure 1: A simplified version of the DD cycle showing the progression of lesions through the cycle.



Figure 2: An early active (M1) lesion.



Figure 3: An active (M2) lesion in the early stages of infection, with hair still present in the lesion.



Figure 5: A healing (M3) lesion with the appearance of a thick black scab.



Figure 4: An active (M2) lesion showing signs of proliferation due to encysting of the DD bacteria within the deeper skin layers.



Figure 6: A dormant (M4) lesion showing thickening of the skin in the interdigital space.

Healing/M3: Topical therapy results in the formation of a firm black scab over the lesion within one to two days (Figure 5). If treatment was administered early enough, before encysting of the bacteria, and is successful then the lesion may appear uninfected once the scab has sloughed off. However, if treatment is delayed and proliferation has occurred a true cure is unlikely and the cow now becomes a 'carrier'. In some cases, if there is incomplete healing or the cows are passing through an aggressive footbath a scab may form, however, once the scab has fallen off the lesion may revert to an active lesion.

Dormant/M4: No ulcerative lesions are present, and the lesion is not painful, however, the interdigital cleft is no longer smooth. Instead there is either hyperkeratosis of the skin around the interdigital space, resembling a horseshoe shape (Figure 6) or the lesion may appear as a 'hairy wart' with proliferative filaments of skin present.

Recurring/M4.1: These are dormant lesions that are reverting back to active lesions (Figure 7). These are the key drivers behind outbreaks on farm.



Figure 7: A recurring (M4.1) lesion with the appearance of a small early active/M1 lesion on top of a dormant/M4 lesion.



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WHY DO CURRENT CONTROL APPROACHES USUALLY FAIL?

It takes an average of four months for an active DD lesion to develop (Krull *et al.*, 2016) so if individual cows with DD are just treated 'ad hoc' when lesions are very obvious, and the cow is lame, it is likely that the environment will be continuously fed with DD, thus constantly maintaining this potential transmission route and driving infection in the herd. Foot bathing is commonly seen as the solution during an outbreak; however, the role of the footbath is in prevention rather than treatment. Once a cow has had a DD lesion it is unlikely she will ever cure due to the treponemes encysting within the skin, however, with treatment the lesion can become dormant. Regular footbathing prevents these dormant lesions recurring and therefore recurrent flare ups.

A DIFFERENT APPROACH: 'BLITZ TREATMENT'

'Blitz' treatment involves the identification and individual treatment of all cows with active/recurring DD lesions at the same time. The aim is to rapidly reduce infection levels in the environment and thus the risk to uninfected cows. The risk of flare ups is then reduced through appropriate preventive measures, the main one being effective footbathing.

Step one: identifying cows needing treatment

Not all cows with active/recurring DD lesions will be lame, therefore mobility scoring is not a reliable way of detecting all lesions. Instead, feet must be inspected individually. The easiest way to do this is when the cows are in the parlour during milking. Washing the feet off first and using an inspection mirror and torch will all increase the chances of spotting all lesions (Figure 8). For dry cows, youngstock or robotic herds this can be carried out at the feed barrier but



Figure 8: Identifying DD lesions in the parlour.

is hindered if the feet are dirty, so extra caution needs to be taken when deciding if a cow needs further inspection or not. All cows with active/recurring lesions should be recorded as requiring treatment.

Step two: treatment

The key to success is to treat ALL cows with lesions simultaneously. When selecting a treatment to use it is important that it resolves the infection quickly, whilst minimising pain to the cow, utilising antimicrobials responsibly and reducing the risk of further encysting of the treponemes deep in the skin.

It should be noted that antibiotic footbaths are not a suitable treatment option as their use falls under prophylactic use of antimicrobials and in addition, the antimicrobial products used in footbaths are not licenced and therefore carry a statutory seven-day milk withhold. Disposal is also a concern due to environmental contamination.

Despite a plethora of products advertised as treating or even 'curing' DD, there is scant evidence-base behind most. When used correctly the licenced topical antimicrobial aerosols fulfil all the treatment objectives and are therefore the product of choice for use in blitz treatment.

Lesions should be treated until they are in the healing stage, such that they form a black scab and are no longer painful (see Figure 5). Typically, three to five consecutive days of treatment is required although this may be less for smaller, earlier lesions (Figure 9) and more for larger chronic lesions (Figure 10). Cows should not be foot bathed whilst they are being treated

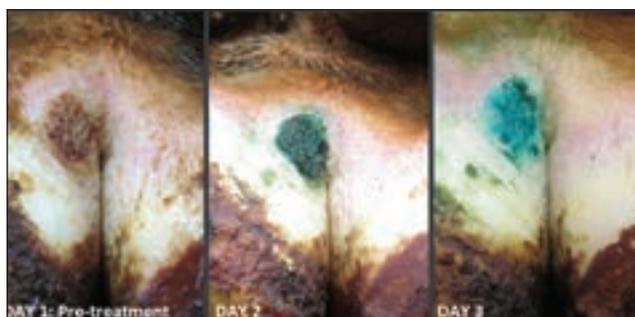


Figure 9: Treatment outcome of a small lesion with a licenced topical antibiotic spray.

Step three: preventing recurrence

Due to the way in which the DD treponemes bury into the skin and encyst, even if treated early, cattle are unlikely to be cured and will instead harbour the bacteria within a dormant lesion, which is at risk of recurring. The key to long-term DD control is to prevent recurrence of dormant lesions and to also prevent new infections in previously uninfected cows. There are three key elements to prevention:

Biosecurity:

Even when DD is present it is still important to practice good internal and external biosecurity. People are not only a risk factor for the introduction of DD onto farm but also between different groups of animals. If youngstock are naive then care must be taken not



Figure 10: Treatment outcome of a large, chronic lesion with a licensed topical antibiotic spray.

to transfer infection from affected adult groups, with certain management practices increasing the risk eg. communal use of a scraper tractor or gathering the herd for management purposes.

Hygiene:

Slurry not only acts as a transmission route for DD but also creates the perfect environment around the foot for it to thrive, as well as causing the necessary skin damage needed for DD to take hold. The dirtier the cows, the greater the risk of DD. Keeping cattle cleaner is essential and can be achieved through more effective scraping out, targeting the timing of automatic scrapers to periods of least cow traffic and minimising slurry pooling in high traffic areas eg. collecting yard. In addition, poor cubicle comfort leading to perching cows, inadequate ventilation and overstocking can all increase exposure to slurry.

Foot bathing:

Traditionally foot bathing has been used as a treatment for DD, however, its role is one of prevention; to prevent new infections in the first instance and to also prevent the recurrence of dormant lesions. Long-term control is reliant on successful control of dormant lesions (Biemans *et al.*, 2018). 'Flare ups' are common when there is a break in footbathing or where it is only used in the face of an outbreak. There are many things to consider when it comes to footbathing including disinfectant used, frequency of footbathing and footbath design.

There is limited evidence behind many footbathing products, with formalin and copper sulphate still the perceived gold standard. Frequency of footbathing is dependent on the individual farm situation, however, it is often the case that the more frequent the better for control. The footbath should be designed to make it easy and stress-free for both farmer and cows. The aim should be to achieve at least three dunks of each hind foot in the bath, which usually requires a footbath 3.7-4m long and designed with optimal cow flow in mind (Figure 11).

Step four: monitoring

Once blitz treatment has been undertaken and effective preventive measures put in place. It is important to continually monitor the herd for the recurrence of old infections or the emergence of new ones. Conducting parlour inspections at least every four weeks is recommended.



Figure 11: Footbath design is important to ensure sufficient immersions of the hind feet to ensure adequate disinfection, whilst optimising cow-flow.

CONCLUSION

For many farms DD is a constant challenge, impacting on the welfare and productivity of the herd. Achieving long-term control is possible through implementation of blitz treatment of all actively infected cows, followed by appropriate prevention measures, including footbathing. However, due to the nature of DD and its ability to recur, it is important that any control measures implemented are continued and constantly reviewed.

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