



A holistic approach to lameness and foot lesions in dairy cows.

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Basic concepts for treatment and prevention of foot lesions in cattle

Lameness in dairy cows can amount to **substantial costs** with an average ranging from **\$185 to \$333 per case** of lameness depending on a cow's parity (Liang et al., 2017). Although the true cost of lameness or foot lesions is often underestimated due to the high number of related costs like lower reproductive capacity, higher risk for metabolic diseases etc.

Prevention, timely identification of lame animals and prompt effective treatment are cornerstones in safeguarding good foot and leg health and reducing the negative impact of lameness on dairy cow welfare.

In the present article, we review in a nutshell the **basic concepts for treatment and prevention of foot lesions in cattle** that every bovine practitioner should know to help his/her farmers and their animals.

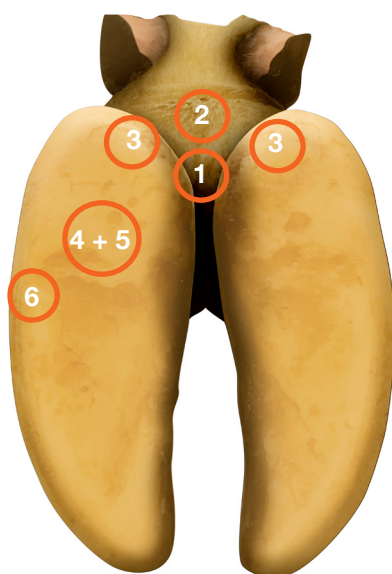
What is lameness?

Lameness in cattle is generally defined as any abnormality in the way cattle walk or stand, typically resulting from pain or dysfunction in the legs or feet.

Lameness can vary in severity ranging from a decrease in symmetry of limb movements to the inability to bear weight on a limb (Van Nuffel et al., 2015).

Foot disorders are generally seen as the most common cause of lameness in dairy cows and mainly occur at the hind legs. They can roughly be classified into infectious (IFLs) and non-infectious foot lesions (NIFLs).

Figure 1 provides a non-limitative overview of the most common foot disorders in dairy cows according to the ICAR classification.



Infectious foot lesions

- 1 Digital Dermatitis (DD)
- 2 Interdigital phlegmon (IP)
- 3 Heel Horn Erosion (HHE)

Non-infectious foot lesions

- 4 Sole bruising (SB)
- 5 Sole ulcer (SU)
- 6 White line disease (WL)

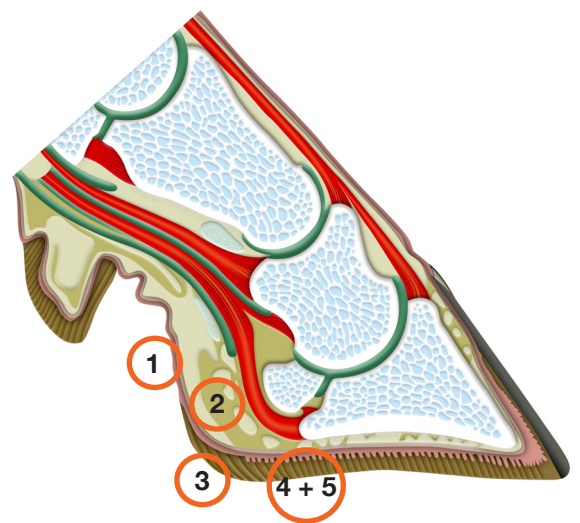


Figure 1 Non-limitative overview of the most common foot disorders in dairy cows according to the ICAR classification.



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Visual locomotion scoring systems

One of the **biggest challenges** of visual locomotion scoring, is the **subjective interpretation of locomotion indicators**, which often leads to inconsistencies or underscoring of locomotion scores.

At the moment, multiple validated locomotion scoring systems are available. The most common locomotion scoring systems used in cattle are either on a 5- (1-5, based on Sprecher et al. (1997)) or a 4-point scale (0-3, Mobility scoring system from the Agriculture and Horticulture Board of Development).

There are some **practical considerations** that need to be taken to ensure reliable and repeatable locomotion scoring:

- Always use the **same scoring system** when scoring cattle. The 5-point scale locomotion scoring system from Sprecher et al. (1997) requires a stationary and dynamic evaluation, in contrast to the mobility scoring system which only requires a dynamic evaluation.
- Score cattle on the **same walking surface**. Ideally a flat, non-slippery concrete surface.
- To reduce inter-observer variability (= reduce perception biases), scoring should each time be done by the **same person(s)**.
- Implement **regular training or calibration** between scorers to ensure high standards. Additionally, pick up feet from scored animals afterwards to validate the presence of foot lesions.

Gait indicator	What to look for in practice when scoring locomotion in cattle
Step length (= tracking up)	Does the back foot land on the spot the front foot just vacated?
Rhythm and fluidity of movement	Is there an even rhythm (i.e. symmetry) during movement over 4 to 5 gait cycles?
Arching of the spine	Is the spine flat or curved during movement?
Weight bearing on limbs during movement	Are the limbs evenly loaded during movement? <i>Practical tip:</i> the degree of sinking of the dew claws can be used to improve the objective evaluation of this indicator.
Head movement (head bob)	Is the head kept level during movement or is there an exaggerated up- or downwards movement?

The most commonly used gait indicators are listed in Table 1.

Table 1: The most commonly used gait indicators in cattle.

Early detection and prompt effective treatment (EDPET) in relation to animal welfare

Continuous monitoring of locomotion combined with **routine preventive foot checks** are the cornerstones of a successful **lameness control plan** on a dairy farm.

Additionally, early detection of lameness (= score $>2/5$ or $>1/3$, within 2 weeks of onset of lameness) and prompt effective treatment (<48 hours of lameness detection) are crucial to ensure adequate long-term recovery of foot lesions (primarily claw horn disruption lesions). Cows with imperfect mobility (Score $1/5$ or $1/3$) benefit from a foot check too.

Early lameness detection generally leads to treatment of lesions at an early stage which results in higher cure rates (= cow not lame 35 to 42 days after treatment) for non-infectious foot lesions ranging from 69 to 88% (Groenevelt et al., 2014; Thomas et al., 2015) compared to treatment of cows that are considered as chronically lame (Thomas et al., 2016) where on average only 15% returns to normal locomotion after treatment.

However, in practice the median interval between lameness recognition and treatment ranges between 28 to 65 days (Alawneh et al., 2012; Leach et al., 2012).

NSAIDs should be part of lameness treatment protocols on every dairy farm as they increase cure rates (cow returning to normal locomotion after a lameness event), reduce local inflammation and subsequent new bone growth (Newsome et al., 2016) and thus reduce the probability of lameness later in life (Wilson et al., 2022).

Pain management medication in dairy cattle is limited therefore it is crucial to focus on early lameness detection (reduce time spent lame as much as possible) and correct therapeutic protocols and supportive therapy to maintain dairy cow welfare at a high standard.

Current treatment and alternatives: Infectious foot lesions

Digital Dermatitis (DD or Mortellaro's disease)

Digital Dermatitis lesions require a similar approach as infected wounds and the treatment protocols should be addressed accordingly:

- **Clean and debride DD lesions mechanically** with gauze or water to remove manure, debris and any potential biofilm present. This step also facilitates proper lesion stage identification and registration. A hoof spreader is an essential tool to identify lesions in the deeper parts of the interdigital cleft.
- **Apply a topical antibacterial product** on lesions that are visually considered as 'active' (M1, M2 and M4.1).
 - Chlortetracycline, oxytetracycline spray or thiamphenicol spray
 - Chelated copper and zinc gel or spray
 - Salicylic acid (has besides its anti-inflammatory capacity also some antibacterial effects)
- **Apply the primary layer of the bandage** that is preferably non-occlusive to ensure wound healing and cause minimal trauma to the wound when removing the bandage.
- **Cover the primary layer with a large layer of synthetic cotton** to prevent constriction of the foot by the tertiary layer. Apply a tertiary layer, generally consisting of a breathable cohesive bandage.
- **Optionally a fourth layer consisting of a protective tape can be added** to ensure the bandage stays on for the desired period depending on the topical product used. This generally varies between 3-7 days.

Using bandages to treat DD has been shown to be advantageous in multiple field studies.

However, whether or not to apply bandages is primarily guided by managerial factors on a dairy farm. If there is reason to suspect that bandages will not be removed in time by farm staff, then it is advisable to limit your treatment protocol to repeated individual topical antibacterial spraying of active DD lesions.

An **appropriate footbath protocol** should be put in place as a hygiene measure to control new infections of DD in heifers, dry cows, and lactating cows. The use of footbaths alone is not effective at controlling large active DD lesions (M2 stage).

Additionally cows that are lame due to active DD lesions (M1, M2 or M4.1 stages) are likely to benefit from a **single parenteral non-steroidal anti-inflammatory drug (NSAID) treatment** such as ketoprofen to improve their recovery from lameness by 40% and reduce average milk yield losses by 2,98 kg compared to only using a topical product such as oxytetracycline spray and a wrap (Kasióra et al., 2022).

Interdigital phlegmon (IP)

Treatment success of interdigital phlegmon relies on the speed of therapy after onset of the disease.

Typical clinical signs to look for, are:

- **Fever** (>39°C) in the acute stage of the disease.
- **Severe lameness** on the affected foot (reluctance to bear weight).
- **Swelling of the foot** (typically bilateral swelling of heel bulbs and swelling of the dorsal part of the foot).

If IP is not treated in time, the skin in the interdigital cleft may burst open and give way to secondary infections by DD or infections of the deeper tissues and/or joints.

Treatment of IP consists of:

- **Systemic parenteral antibiotic and NSAID treatment** for at least 1 week
 - First choice antibiotics:
 - ♦ Penicillin or Cefalexin
 - Second choice antibiotics:
 - ♦ Broad spectrum penicillins (such as amoxicillin or penicillin and dihydrostoptomycin)
 - ♦ Tylosin
 - ♦ Oxytetracycline
 - ♦ Tilmicosin
 - Third choice (local regulations may apply before use of these classes of antibiotics):
 - ♦ Cefquinome
 - ♦ Ceftiofur
 - NSAID:
 - ♦ Ketoprofen: every 24 hours
 - ♦ Carprofen: every 72 hours
 - ♦ Meloxicam: every 48 hours

- **Foot check** to ensure there are no other lesions present on the affected foot
 - If other lesions are present, treat accordingly
 - Local topical treatment if skin in the interdigital space has ruptured
- **Follow-up** to ensure lesion is healing properly
 - Clinical improvement should be seen within 2 days, if there is no improvement (i.e. cow still lame) then a thorough foot inspection is needed in a foot trimming crush.



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Current treatment and alternatives: Non-infectious foot lesions

The treatment options for non-infectious foot lesions (commonly called claw horn disruption lesions, CHDLs) are limited and therapy success is often dictated by the interval between the onset of lameness and treatment.

Ideally, treatment is performed within 2 weeks after onset of lameness. General guidelines are to treat lame cows (mobility score 2/3) within 48 hours and severely lame cows (mobility score 3/3) within 24 hours.

Based on the findings of the randomised clinical control trial performed by (Thomas et al., 2015), the current standard for CHDL treatment is therapeutic trimming, a block on the healthy partner hoof and supportive therapy by a systemic NSAID treatment (ketoprofen every 24 hours for 3 days).

The addition of parenteral NSAID therapy increases recovery rates by 20,2% after 5 weeks compared to the traditional therapeutic trimming and block treatment.

Treatment of CHDLs generally consists of alleviating the interaction between the affected hoof and the walking surfaces:

- **Curative functional hoof trimming** to identify the location and severity of the lesion. The use of a hoof tester is an indispensable asset to identify pain in a hoof where lesions are not clearly visible (yet). Reduce the heel of the affected hoof as much as possible without breaching the hoof horn and exposing the corium. The latter facilitates in visualizing lesions that are close to the corium.
- **Apply a block** to the healthy hoof on the same foot to relieve the affected hoof.
- If **proliferative lesions** are present (sole ulcer or white line defect), **reduce the surrounding horn** as much as possible until it flexes under slight finger pressure. Sometimes **corium** can be affected by a secondary bacterial colonization (DD-associated lesions). These need to be surgically debrided after intravenous regional anaesthesia. Remove all the affected corium and apply a compression bandage with an antibacterial spray (CTC spray) or antiseptic product.

Dynamic and pro-active approach at herd level

An effective lameness prevention program on a dairy herd relies on multiple crucial measures that require:

- **Periodic preventive foot checks:**

These are often scheduled in function of the days in milk. The most common time periods are after peak lactation (around 100 days in milk) and at dry-off. However, these need to be adjusted in function of the lactation cycle of a cow, the type of farm and the environment of a farm. Routine foot checks and trimming need to be performed by a skilled staff member or skilled foot trimmer.

- **Continuous lameness monitoring:**

Early lameness detection and prompt effective treatment are crucial to prevent lesions from becoming chronic. Ideally, visual locomotion scoring is performed every 2 weeks by a trained and calibrated observer in an independent manner to maximally reduce bias.

- **Effective treatment protocols for lame cows:**

Lame cows should be treated as soon as possible or ultimately within 48 hours after detection. Treatment should be performed by a skilled staff member or external professional with a therapeutic trim, block and NSAIDs. Treatment protocols for IFLs (antibiotics) and NIFLs (NSAIDs) need to be discussed and set in place with the farm veterinary team to guarantee regulated access to the required veterinary products.

- **Controlling infection pressure of IFLs and preventing new infections:**

Regular foot bathing or other preventive measures need to be applied in all lactation stages (lactating cows, dry cows and young stock). Good leg cleanliness (identified by leg hygiene scores) helps to reduce the spread of IFLs by ensuring dry and clean skin on the feet and legs.

- **Optimize and invest in cow comfort:**

Every second a cow is not standing on concrete, is a second she is less likely to develop a foot lesion.

Properly adjusted cubicle dimensions and bedding surfaces ensure sufficient lying times and decrease the risk for foot lesions and concomitant lameness.

Overstocking should be avoided at all times or kept to a minimum due to the deleterious effect on cow and farm time budgets.

Optimizing milking times and reducing time out of pen are two other key metrics that can be used to reduce the forces on a cow's foot and the subsequent exposure to concrete.

Parlour sizes and milking routine should be matched to milking group sizes or vice versa, to ensure time out of pen is kept to a reasonable 50 to 70 minutes per milking.



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