Laminitis – Prevention, Diagnosis and Treatment

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Take Home Message

- Laminitis occurs mostly around calving, triggered by the calving process.
- Management around calving is difficult and not every calving is easily manageable.
- Nutrition plays an important role in laminitis, but housing conditions, breeding, body condition, overburdening of claws and the use of a closeup or transition group are also important factors.
- Laminitis can be categorized in three forms: acute, sub-acute and chronic.
- Lameness by laminitis is difficult to recognize, unless one foot is more painful than the other.
- Functional foot trimming approximately two months before calving can prevent/ minimize lameness after calving.
- Foot trimming two to three times per year is advised.
- Preventative trimming is much easier to do than curative trimming
- Curative trimming relieves the painful claw and restores normal behavior of the cow.

Introduction

Laminitis is a metabolic disorder of the corium in the digits/claws causing a lot of discomfort to dairy cows. The disorder affects over 80% of dairy cows (The Netherlands). Laminitis affects the lamellae of the claw. This is on the dorsal wall of the claw and is recognized by a buckled toe. This is the reason the disorder is called Laminitis. In horses, the main effect of laminitis is in the hooves, but in dairy cows most of the damage by Laminitis is seen on the walking surface of the claws, the sole and white line region. This region is not the lamellae region, but the papillae region of the claw. Internationally this is cause of discussion about the name of the disorder.

Laminitis causes more discomfort than is generally assumed. Regular functional foot trimming can prevent the severity of lesions in the sole and white line region by dividing the weight-bearing equally on both claws. When cows are lame, curative trimming will reduce pain and therefore lameness. With curative trimming the weight-bearing is transferred from the damaged claw to the healthy claw.

Laminitis

Laminitis is a disorder of the corium of the claws. It occurs mostly around calving and is strongly influenced by management factors. In a recent study in the Netherlands (claw health in dairy cows in the Netherlands, Menno Holzhauer) 80% of the dairy cows had one or more signs of disorders in their claws. Sole haemorrhage and white line defects were seen in most of these cases.

Laminitis can be categorized in three forms:

- Acute laminitis
- Sub-acute laminitis
- Chronic laminitis

Acute Laminitis

Acute laminitis, like the name suggests, is an attack of laminitis on a very short term basis. The cause should be looked for in other diseases that went through the herd or the affected cow. Metritis, (E-coli) mastitis and BVD are examples of diseases causing acute laminitis.

Sub-Acute Laminitis

Sub-acute laminitis is the most common form of laminitis in dairy cows. This mainly occurs around calving. The calving process is the onset of the laminitis. It starts about 7-10 days before calving and lasts until 7-10 days after calving. The lameness signs often appear 2 - 4 weeks after calving. Lameness is often recognized too late, although "stiff, tender walking" is often observed, but not seen as lameness. When lameness due to laminitis is not recognized, it is called sub clinical laminitis.

Chronic laminitis

Chronic laminitis is the result of acute and/or sub-acute laminitis and shows often a few months after the attack of laminitis. This is the damage to the lamellae that is deforming the dorsal wall of the claw and can be recognized by a buckled toe.

Diagnosis

Acute laminitis is recognized mainly by a double sole (Figure 1). Depending on the interval between trimming and the time of the laminitis attack, there may be more than one "loose sole". In the very early stage the sole is separated from the corium and the corium is exposed. Acute laminitis occurs often as an individual case.



Figure 1. Double sole, acute corium exposed

Sub acute laminitis is more complex in diagnosis. The main damage seen during trimming is discoloration of the sole from yellow to red (haemorrhage) that is seen all over the sole area (Figure 2). The discoloration can also be more specific on certain areas of the sole like on the typical sole ulcer site or in the solar part of the heel horn. A sole ulcer (Figure 3) is a common defect. White line defects are the highest risk for lameness. They range from discoloration to separation of the wall of the claw. If the separation is up to the corium a wall ulcer is present (Figure 4).



Figure 2. Discoloration of the sole



Figure 3. (typical) sole ulcer



Figure 4. White line defect, the corium exposed (wall ulcer)

In the rare case the tip of the toe may be affected and may cause toe necrosis (Figure 5).



Figure 5. Toe exposed, toe ulcer, possible necrosis of the toe

Chronic laminitis is recognized by a dent in the dorsal wall (buckled toe, Figure 6). Here the lamellae are damaged by laminitis. It is hard to determine the time of damage. Once a toe is buckled, it will always be buckled. The lamellae can heal to some extend, but never recover completely. This means the buckle in the toe will be there for the rest of the cow's life. The result is that wear and growth will be affected after the damage and results in overgrowth. More frequent trimming is necessary to keep the "normal function" in the claws.



Figure 6. Dented dorsal wall ("buckled toe")

In general the hind outer claw is affected, but in some cases the hind inner claw is also affected. Front feet are less affected.

Prevention

Parturition is often the onset of laminitis. Hormonal and nutritional changes are tremendous around calving. Management also has a large influence on Laminitis. Rumen acidosis is a well known cause. Nutrition around calving is difficult; it is important to ensure that cows consume sufficient fiber and have good dry matter intake. Feed quality is also important; moldy feed or poorly conserved silage are risk factors (forming of histamines/ toxins). The quality of concentrate used in the TMR must also be high. Environmental conditions like flooring (concrete, slats etc), cow comfort (cubicle design) and ventilation are influential factors. For instance, it has been shown that the incidence of haemorrhage of the soles is very low when rubber flooring is used. Lying time of cows (cubicle/ stall design) has been connected to the incidence of sole haemorrhage, with long standing times and short lying times being contributing factors.

Infectious diseases can easily form toxins in the blood circulation, which can cause thrombosis in the capillaries or narrowing of the blood vessels in the corium and therefore haemorrhage of the sole. Other foot diseases have an influence on laminitis, for example, Interdigital Dermatitis is a disease causing overgrowth in claws.

Breeding can also have a big influence on the susceptibility to laminitis. Difficult calving throws the cow back quite a bit. Choice of sire for easy calving can help here. Breeding for high milk yield also has an influence; body capacity of the cow (higher roughage intake potential) should not be forgotten. Young stock rearing is a factor too. Although young stock are not producing milk doesn't mean that good rearing management should be overlooked.

Overburdening (mainly the hind outer claw) will put more strain on the corium of the claw and cause it to overgrow even more. Regular foot trimming will prevent overburdening of the hind outer claw around calving. Laminitis deforms the claws and therefore the normal function of the claw. This is a reason for claws to overgrow. Regular foot trimming can return the claw to a more normal shape and function. Preventive foot trimming in the Netherlands is recommended to be performed twice a year based on the average level of laminitis, interdigital dermatitis and housing/ grazing conditions. In the case of lameness curative trimming is necessary. Trimming cows' feet at drying off and spreading the weight-bearing equally over both claws prevents overburdening around calving. In case of defects in the claws they can recover in the dry off period. Laminitis is a multi factorial disease and the main factors of influence are mentioned above. It is important to know if Laminitis on a farm is a herd problem or an individual (cow) problem. An individual case should be dealt with as an accidental case. In the case of a herd problem management should be looked at. Laminitis can often not be pinned down to one factor. Total prevention of Laminitis in dairy cows is not possible but should be limited to an acceptable level, i.e., there should be no lameness or discomfort!

Treatment of Laminitis

Treatment of laminitis is primarily trimming. Pain killers can be administered but is not often done in the Netherlands. Rumen buffers are administered right after calving to help the rumen flora.

As mentioned before, lameness caused by laminitis often shows as an after effect about 2 - 4 weeks after calving. The laminitis itself is then in most cases not a problem anymore although it is still called laminitis. Functional foot trimming is then the only solution to treat the lame cow. Functional foot trimming consists of routine and curative trimming.

Here the "Dutch Method" of foot trimming will be discussed. This method was developed in the 'seventies' by Mr. E. Toussaint Raven, DVM from the Veterinarian University of Utrecht in the Netherlands together with PTC+ in Oenkerk. Here the short version of the so called "**five step schedule**" in functional foot trimming will be described. Because lameness is more prevalent in hind feet, the schedule is based on the hind feet. When front feet are trimmed the inner (medial) and outer (lateral) claws are switched in the schedule.

The first three steps are the routine or preventative trimming and the last two steps are the curative trimming. The use of claw blocks or shoes and bandages are part of the curative trimming. Because the trimming is usually done by foot trimmers (professional) or farmers/farm workers, surgical procedures are not dealt with in this method. This has to be done by a veterinarian because foot trimmers/ farmers are not licensed to do so.

"Five step schedule" The Dutch method:

In hind feet the outer (lateral) claw is often the overgrown claw and the damaged or lame one. The shape of the claw is often damaged by laminitis. The result is overloading of the claw. The inner (medial) claw is often hardly overgrown and the weight-bearing surface has too little stability and therefore takes less than 50% of the body weight. The length of the dorsal wall of an average size Holstein Friesian cow is 7.5 cm. The normal sole thickness is 0.5 cm. To restore the normal function in the foot of a cow the aim of the

trimming is to restore the normal length and stability in the claws and to have the weight spread equally over both claws. This must occur within the normal margins in the claws. The sole thickness should be at a minimum of 0.5 cm. If claws are at a length of 7.5 cm or less, then the sole thickness at the toe is 0.5 cm or less and caution with trimming is necessary. Stability in the claws is necessary because cows are kept on a hard surface. A natural shaped claw will not stand up right on a hard surface; this will damage the inner structure of the foot.

Routine Trimming:

Step 1:

The inner claw of the hind foot is cut back to 7.5 cm (Figure 7: 1A). The cut should be perpendicular to the sole of the claw. Then trim down the inner claw toe to 0.5 cm (Figure 7: 1B) and leave the bulb or heel untouched. The trimming of the sole should be perpendicular with the axle of the foot so that the claw can stand upright on the floor.



Figure 7. Trimming the inner claw

The claw angle of the inner claw is back to normal as much as possible. The sole thickness should not be over trimmed. Sufficient protection is necessary.

Step 2:

The outer claw is cut equally long as the inner claw (7.5 cm) and the sole equally high as the inner claw (Figure 8), if possible. This is the easier part of the trimming. The inner claw is used as an example for the outer claw. However, the outer claw is often deformed and therefore you must be aware of the shape of the dorsal wall! The toe sole thickness cannot be measured by the cutting edge at the toe; it has to be compared with the inner claw by holding the dorsal walls at the same level. Note here that the outer claw has to be held at the buckle of the dorsal wall. When the soles are then at the same level, the sole thickness is right, even if the cutting edge at the toe of the outer claw looks a lot thicker than 0.5 cm.



Figure 8. Equal height of the heels and toes

Step 3:

Shaping the claws. The inner part of the sole is removed starting at 2.5-3 cm from the toe till the heel area. The axial (inner) wall of the toe area should not be trimmed. This part is very important for the stability of the claw. Trimming in this part of the wall easily lames the cow and recovery is very slow. The shaping of the claws is mainly done to inspect the typical sole ulcer site and for cleaning of the claws. Even if the contra pressure of the floor is removed this is not seen as release of pressure on the typical site.



Figure 9. Concavity or hollow shape in the claws

Curative Trimming:

Step 4:

Height difference: In the case of lameness or severe damage to a claw, mostly the outer claw, the sole is trimmed down a lot more than the inner claw if possible. This is in the last 2/3 part of the rear sole area (wedge). This is done to transfer the weight from the painful claw to the healthy claw and

relieve the painful claw (Figure 10). This increases the healing of defects such as a sole ulcer, wall ulcer or white line defect. It is not always possible to create a height difference by trimming. In this case a block can be applied and create an unnatural height difference (Figure 11).



Figure 10. Height difference by trimming



Figure II. Height difference with block

Step 5:

Loose horn and hard ridges should be removed in the inner claw only in the last part of the heel. Often heel horn erosion by interdigital dermatitis causes the undermining of the heel horn. In the outer claw, the part where the wedge is made (2/3 part of the sole) and the sole is lowered (step 4), loose horn and hard ridges around the lesion should be removed (Figure 12).



Figure 12. Removing of loose horn and hard ridges

Now the foot is checked for other diseases like digital dermatitis and decisions made regarding treatment.

In routine trimming, the other foot is also trimmed or all four feet may be trimmed. In case of curative trimming of a lame foot, the other foot has to be checked too. In case of lameness of a front foot, check all four feet.

The length of the dorsal wall is very important to know how much of the sole can be removed. According to the length three types of claws can be found. 1. a long claw , 2. a normal length claw and 3. a short claw. In the first case, "a long claw", the dorsal wall is cut back to 7.5 cm. and the sole at the tip of the toe cut back to 0.5 cm. In the case of the "normal length" claw, the claw is not cut back (has the right length) and the sole thickness in the tip of the toe is alright, so no trimming is done (step 1). The third possibility is the "short" claw. Here the tip of the toe is too thin (over wear) and no trimming should be done (step 1). In all cases the other steps of the schedule can be followed if necessary.

Warning: Protection of the corium is **the no.1 task** of the sole, so this must be considered as the most important in routine trimming. In case of curative trimming the curing of the lesion is important, but the cow has to stay mobile.

Conclusions

Laminitis is often a herd problem occurring around parturition. Farm management is very important for minimizing the severity and incidence of the disease. Nutrition plays a large role in laminitis, as does housing like stall (cubicle) comfort. Individual cases of laminitis are often an incidental case and more accidental, so not easy to prevent.

Regular foot trimming is a tool in preventing laminitis and certainly a tool in treating "Laminitis" causing lameness. Defects seen during trimming are mainly signs that the cow suffered from laminitis before. By curative trimming the painful claw is released partly or completely of pressure and the cow can return to normal behaviour without pain and recover quickly.

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