

Sheep lameness: common types, causes and control strategies

Author : Lee-Anne Oliver

Categories : [Farm animal](#), [Vets](#)

Date : June 26, 2017

Sheep lameness presents a huge challenge in terms of welfare and economics.

Kaler and Green (2008) conducted a study where 809 English sheep farmers were asked to identify six foot lesions; only 20% of farmers named all six lesions correctly. This study highlights the necessity of involvement vets have in advising and educating producers about sheep lameness.

Foot lameness in sheep can be attributed to infectious or non-infectious causes.

The three infectious causes of lameness covered in this article are:

- Ovine interdigital dermatitis (OID), often referred to as scald.
- Foot rot.
- Contagious ovine digital dermatitis (CODD).

Non-infectious causes of foot lameness are of a lower incidence and include:

- White line degeneration.
- Foot abscess.
- Toe granuloma.

Obtaining an accurate diagnosis is essential in advising on prevention, control and treatment. Often, one or more conditions are present on a farm. Lesions can be in the early or chronic phase, where they can appear grossly very different, so a sufficient number of animals need to be examined to achieve a diagnosis.

OID

OID is a necrotising infection by *Fusobacterium necrophorum*, a Gram-positive aerobe in the absence of *Dichelobacter nodosus*. OID and the initial stages of benign foot rot can appear similar in clinical appearance (Raadsma and Egerton, 2013). As *F necrophorum* is ubiquitous in the environment, it is considered impossible to eradicate OID from a flock. Treatment with

oxytetracycline spray to all four feet is often effective (Winter, 2004).

Control of OID involves frequent footbathing with formalin (2% to 3%) or zinc sulphate (10%) to maintain a healthy interdigital environment. Raadsma and Egerton (2013) suggest footbathing the whole flock once a week during the high-risk period. The environment should be kept as clean and dry as possible – particularly muddy areas, such as gateways and feed troughs. Where possible, after footbathing, sheep should be grazed on pasture that has been free from sheep for two weeks (Green, 2015).

Foot rot

Foot rot is defined by the invasion of the epidermal tissues of the hooves by a mixed group of bacteria, namely *D nodosus* and *Bacteroides nodosus* (Raadsma and Egerton, 2013).

Devitalisation of the interdigital skin from a wet environment and subsequent infection with *F necrophorum* is required for the bacteria to gain entry. A synergistic relationship between *F necrophorum* and *D nodosus*, therefore, exists (Raadsma and Egerton, 2013). *D nodosus* has several serogroups, some more virulent than others. This, along with the interaction with the host and its environment, determines whether the clinical presentation is mild (benign) or invasive (virulent; Winter, 2004).

Within the ovine population, genetic variation exists in resistance to *D nodosus*, and genetic marker tests are being developed (Winter, 2004). The benign form may only present as a moist, smelly, interdigital space, with no “under-running” of the wall and sole. The virulent infection often involves separation of the hoof wall and sole, and exposure of sensitive underlying structures (**Figure 1**).

The severe painful lesions characteristic of virulent foot rot occur because of the proteolytic enzymes produced by the virulent strain of *D nodosus* (Raadsma and Egerton, 2013). Sheep can achieve a full recovery, although misshapen horn may remain. Even recovered animals are carriers and continue to contribute to bacterial environmental contamination. *D nodosus* can survive in the environment for up to one week (Winter, 2004).

Specific measures to control foot rot are:

- Affected animals should be treated promptly with either penicillin/streptomycin mixture (at twice the usual dose rate), long-acting oxytetracycline, tilmicosin or tulathromycin. The animals should be kept in a clean, dry environment (Winter, 2004). Treatment within three days of disease occurrence prevents the spread of disease, but treatment within six days of becoming lame does not prevent other animals becoming infected. However, it does stop the production-limiting aspects of lameness (Green, 2015).
- Footbathing is aimed at the prevention of OID and, as a result, prevention of subsequent infection with *D nodosus*. Footbathing sheep affected with foot rot will be of some benefit,

but it will not cure them.

- An IV foot rot vaccine can be used to accelerate recovery in infected animals and prevent infection in the unaffected portion of the flock.

CODD



Figure 2. Healing contagious ovine digital dermatitis lesion where horn capsule has been removed.

CODD was first reported in 1997 (Harwood et al, 1997) and is prevalent in the UK and Ireland. In contrast to foot rot, the lesions tend to start at the coronary band and “under-run” the hoof wall and sole. Complete degloving of the hoof capsule can result in extreme cases (**Figure 2**).

CODD causes severe, non-weight bearing lameness, loss of condition and recumbency. CODD is considered to be of bacterial cause. *Treponema* species and *D nodosus* have been isolated from clinical cases of CODD although the specific aetiology and pathogenesis of disease is not yet understood. Anecdotally, the incidence and prevalence of infection is worst after its introduction into a previously uninfected flock. Farmers that reported bovine digital dermatitis (BDD) in their cattle were more likely to report CODD in their sheep (Angell et al, 2014), and links have been made through gene sequencing between CODD and BDD (Davies, 2011).

No products are licensed in the UK for treating CODD. Parental administration of tilmicosin has been used in the control of CODD (Sawyer, 2010). Duncan et al (2011) conducted a split flock treatment trial comparing two groups of sheep footbathed with 1% chlortetracycline solution once daily for three days. One of the two groups also received an injection of long-acting amoxicillin at a

dose rate of 15mg/kg. Clinical recovery was evident in both groups, although the recovery rate was significantly improved in the group that also received an injection of long-acting amoxicillin.

The use of disinfectant footbaths in the treatment of CODD is not considered to be effective. Formalin solution can often be extremely painful for animals with CODD lesions. Success has been reported using antibiotic solutions of tylosin (1g tylosin per 1L of water; Sargison, 2008), or lincomycin/spectinomycin combination (Winter, 2004). A 20-minute contact time is recommended and the antibiotic should be allowed to dry on the feet before a return to pasture. This may need to be repeated several times in quick succession.

Antibiotic footbaths present legislative, health and safety and environmental difficulties. Alternatively, a small quantity of footbath solution can be used in a hand sprayer and sprayed on all feet of affected sheep and allowed to dry. This treatment is off licence.

The impact of foot rot vaccination on CODD was loosely trialled by Duncan et al (2012). Long-acting amoxicillin was administered to two groups of lambs (748 in total) and IV foot rot vaccine administered to one of the two groups. No statistically significant difference occurred in CODD recovery rate between the two groups, but new CODD infection rates in the vaccinated group were reduced. This is one study on one farm, but supports the role of *D nodosus* in the aetiopathogenesis of CODD and alludes to the fact foot rot vaccination may help in the control of CODD. The study also concluded an association between having foot rot, and acquiring a CODD infection.

As they are both contagious bacterial foot conditions many of the control measures for foot rot also apply to CODD.

Generalised measures in the control of foot rot and CODD are:

-



Figure 3. Housing sheep pre-lambing can increase the rate of transmission between affected and unaffected ewes.

Quarantine of incoming animals is crucial to prevent the introduction of foot rot into a flock. New and returning stock should be quarantined for more than three weeks (Green, 2015). Sheep that become lame during quarantine should not be added to the flock.

- Replacement ewe lambs should be selected from ewes that have not been lame. This requires accurate record keeping.
- Low stocking densities of four ewes per acre have been associated with a reduced incidence of foot rot (Green, 2015). Housing ewes can be of benefit as they are in a dry environment, but housing can also increase the rate of transmission between sheep if affected and unaffected sheep are housed together. This is often the case at lambing time (**Figure 3**).
- Separation of infected and uninfected animals allows infected animals to receive treatment and decreases the infection pressure on the rest of the flock. Infected animals should always be handled last – any area where they have access will effectively be contaminated and infective to susceptible animals for two weeks.
- A strict culling policy is required to remove carrier animals from the flock. Affected animals need to be identified by ear notching, electronic identification or spray. Any animal lame more than once in a season should be culled (Green, 2015).
- Foot paring should only be used to remove obviously loose horn. Horn trimmings should be disposed of carefully, and foot trimming shears disinfected between feet. Sullivan et al (2014) demonstrated the survival of treponeme species on cattle and hoof trimming equipment.

Footbathing guidance

Table 1. Comparison of formalin and zinc sulphate use for footbathing	
Formalin	Zinc sulphate
<ul style="list-style-type: none"> • Formalin is an aqueous solution of formaldehyde – 40 per cent w/v with methanol added as a stabiliser (Parajuli et al, 1989). • Effective in concentrations as low as 2.5 per cent. In concentrations above 2.5 per cent, formalin remains bactericidal in the presence of organic matter (Abbot and Lewis, 2005), but concentrations above 5 per cent should be avoided (Sargison, 2008). • Irritant to soft tissues and can delay the healing process in severe cases of foot rot (Parajuli et al, 1989). • Considered to be effective in mild foot rot cases (Parajuli et al, 1989). • Cannot penetrate hoof keratin and is unable to have an effective anti-bacterial effect on deeper infected tissues (Parajuli et al, 1989). • Use within two months of zinc sulphate is not recommended as it hardens the tissues and prevents the penetration of zinc sulphate (Sargison, 2008). • Irritant and carcinogenic to man. Listed as a hazardous chemical under Control of Substances Hazardous to Health regulations. Personal protective equipment should be worn and footbathing should take place in a well ventilated area. 	<ul style="list-style-type: none"> • Zinc can penetrate the hoof keratin. The addition of 40 per cent sodium dodecyl sulphate (or washing up liquid) can aid penetration further (Sargison, 2008) and reduce contact time. • Sheep are less reluctant to walk through zinc sulphate, as it is less irritant (Parajuli et al, 1989). • Not irritant or carcinogenic, tolerated well by man and sheep.

Table 1. Comparison of formalin and zinc sulphate use for footbathing.

Footbathing is a way of exposing a large number of susceptible sheep to an antibacterial solution, and facilitates frequent application (**Panel 1**). The main aim of disinfectant footbath solutions is to maintain the health of the interdigital skin. Footbathing has a role in treating scald, but is ineffective

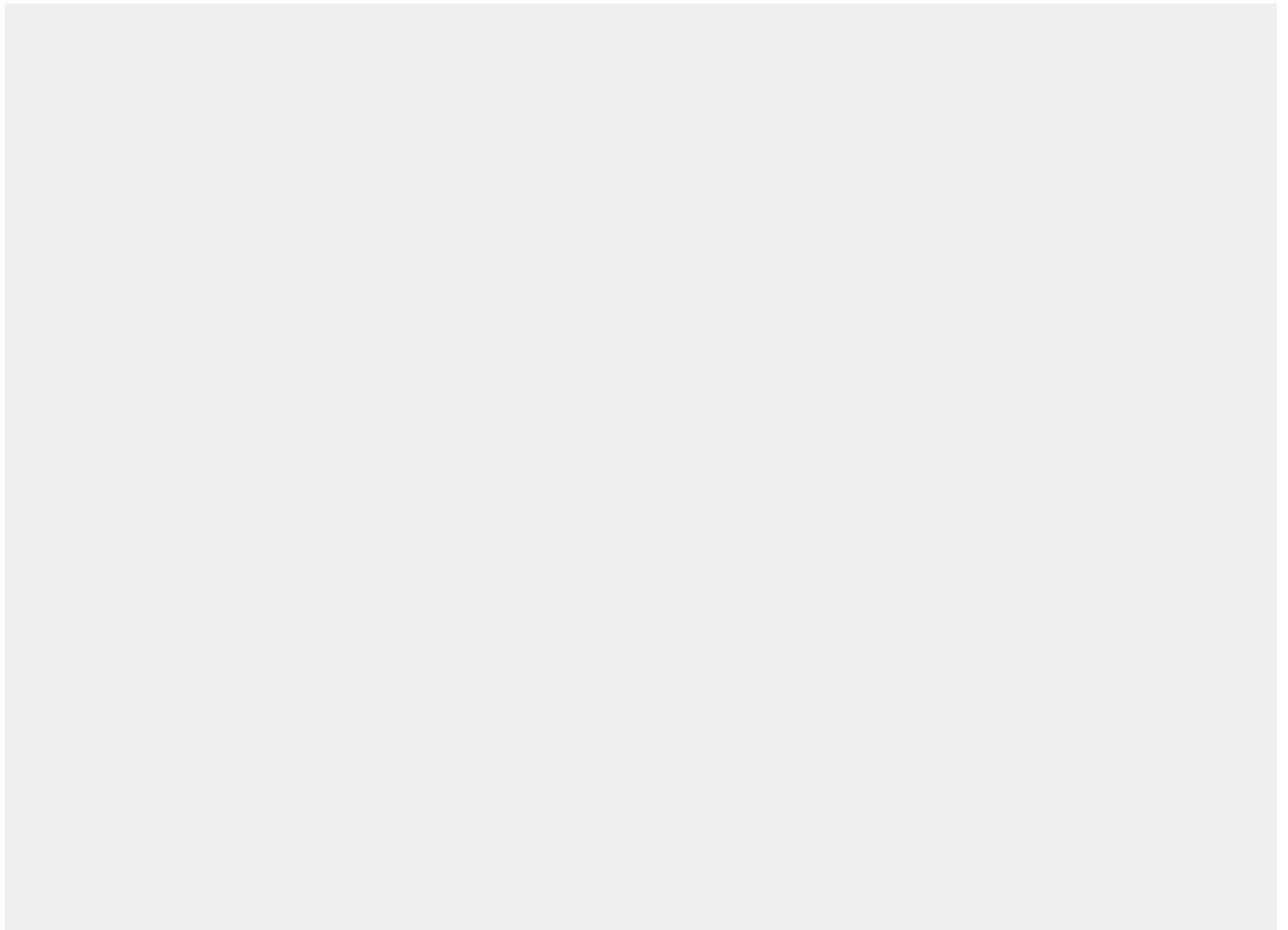
in treating foot rot once the hoof wall is involved. Many chemicals are available on the market, each with their own merits. Formalin and zinc sulphate have traditionally been used in footbath solutions.

Table 1 shows a comparison of the two products. Copper sulphate solutions are not recommended, as they stain the wool and a risk exists of copper poisoning from ingestion of the solution.

Conclusion

Well established methods of control exist for the three major infectious causes of lameness in the UK. Our job as vets is to ensure farmers are correctly advised in the diagnosis, treatment, control and prevention of such diseases. Excellent support material exists to help educate producers on sheep lameness.

The five-point plan is detailed in the Agriculture and Horticulture Development Board's (AHDB) "Reducing lameness for better returns" manual (AHDB, 2016). This helps producers understand the intricate balance between immunity and challenge.



Panel 1. Best practice guidelines for footbathing sheep.

- The footbath should be long enough – 6m to 12m is recommended (Abbott and Lewis,

2005).

- The footbath solution should be deep enough to cover the interdigital space and coronary

band (approximately 5cm to 8cm).

- Feet should be free from soil and faeces before entering the footbath. This may be

achieved by having a water filled pre-bath.

- Once the footbath becomes heavily contaminated, dispose of contents and refill.

- Sheep should progress unhurried through the footbath to avoid splashing and ensure all

four feet are bathed (Abbott and Lewis, 2005).

- Sheep should be allowed to stand on a clean, dry, hard surface for 30 minutes after

footbathing, this is especially important if pastures are wet. They should then be turned out

on to pasture where no sheep have been for 14 days.

- Separate infected sheep and run them through the bath last.

- Footbathing should take place on a dry day, and ideally in clean, dry and concrete handling

facilities. A pre-planned entry and exit route into the handling facilities is essential so sheep

do not have to cross over where they walked before they were bathed. If suitable facilities

are not available then gathering and footbathing can make things worse, increasing

infection pressure and creating a “bacterial soup”.

- No standardised studies exist to establish recommendations on the time sheep should

remain standing in the footbath solution, and the frequency they should be footbathed. The

two factors are linked. Short treatment times are effective when repeated more frequently

(Abbott and Lewis, 2005). During wet weather, when sheep are stood in muddy, stony

conditions, more frequent footbathing is required – this may be once every week.

References

- Agriculture and Horticulture Development Board (2016). Reducing lameness for better returns, <http://bit.ly/2r1OaMd> (accessed 17 April 2017).
- Abbott KA and Lewis CJ (2005). Current approaches to the management of ovine footrot, *Veterinary Journal* **169**(1): 28-41.
- Angell JW, Duncan JS, Carter SD and Grove-White DH (2014). Farmer reported prevalence and factors associated with contagious ovine digital dermatitis in Wales: a questionnaire of 511 sheep farmers, *Preventive Veterinary Medicine* **113**(1): 132-138.
- Davies I (2011). Treatment options for contagious ovine digital dermatitis, *Veterinary Record* **169**(23): 604-605.
- Duncan JS, Grove-White D, Oultram JW, Phythian CJ, Dijk JV, Carter SD, Cripps PJ and Williams HJ (2011). Effects of parenteral amoxicillin on recovery rates and new infection rates for contagious ovine digital dermatitis in sheep, *Veterinary Record* **169**(23): 606.

- Duncan JS, Grove-White D, Moks E, Carroll D, Oultram JW, Phythian CJ and Williams HW (2012). Impact of footrot vaccination and antibiotic therapy on footrot and contagious ovine digital dermatitis, *Veterinary Record* **170**(18): 462.
- Green L (2015). Lameness control in flock health planning, *Cattle Practice* **23**(1): 107-111.
- Harwood DG, Cattell JH, Lewis CJ and Naylor R (1997). Virulent footrot in sheep, *Veterinary Record* **140**(26): 687.
- Kaler J and Green LE (2008). Naming and recognition of six foot lesions of sheep using written and pictorial information: a study of 809 English sheep farmers, *Preventative Veterinary Medicine* **83**(1): 52-64.
- Parajuli B and Goddard, PJ (1989). A comparison of the efficacy of footbaths containing formalin or zinc sulphate in treating ovine foot-rot under field conditions, *British Veterinary Journal* **145**(5): 467-472.
- Raadsma HW and Egerton JR (2013). A review of footrot in sheep: aetiology, risk factors and control methods, *Livestock Science* **156**(1-3): 106-114.
- Sargison N (2008). *Sheep Flock Health a Planned Approach*, Blackwell Publishing, Singapore: 305-311.
- Sawyer (2010). Use of tilmicosin for the management of contagious ovine digital dermatitis and footrot, *Proceedings of the Sheep Veterinary Society* **34**: 95-98.
- Sullivan LE, Blowey RW, Carter SD, Duncan JS, Grove-White DH, Page P, Iveson T, Angell JW and Evans NJ (2014). Presence of digital dermatitis treponemes on cattle and sheep hoof trimming equipment, *Veterinary Record* **175**(8): 201.
- Winter AC (2004). Lameness in sheep 1. Diagnosis, *In Practice* **26**(2): 58-63.