Foot Rot (Interdigital Necrobacillosis)

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Introduction

Interdigital disease remains a major cause of lameness. Russell et al (1982) described interdigital necrobacillosis ("foot rot") as the most common cause of lameness in the UK, although there was considerable geographical variation. Collick et al (1989) demonstrated that the incidence of interdigital disease ("foot rot", interdigital skin hyperplasia and interdigital dermatitis) varied with stage of lactation, but was generally lower than the incidence of digital disease and solar ulceration. In a survey of 427 cases of lameness, 133 were caused by sole ulceration, 204 by digital disease and 90 (21%) by interdigital disease. More recently, in a survey of over 13,000 cases of lameness, Ward and others (personal communication) found incidences of 5.2%, 5.1% and 0.8% for foot-rot, interdigital skin hyperplasia and interdigital dermatitis respectively, namely 11.3% interdigital disease.

Based on the work of Collick et al (1989) and using data from the DAISY herd health and fertility programme, Esslemont (1992) has estimated the cost of a single case of interdigital lameness to be £99.88 (US$ 150.00). This is based on estimates of the time spent by the herdsman and the veterinarian in treatment, drug costs and yield reduction, with the major cost being the subsequent effects of lameness on fertility.

Interdigital lesions are often inter-related. For example, chronic irritation caused by interdigital dermatitis (IDD) appears to stimulate interdigital skin hyperplasia (IDSH = "corns", "tylomas") lesions and conversely, IDD may be seen as a cause of low-grade inflammation on the surface of an established area of IDSH. Similarly, by damaging the epidermis in the interdigital cleft, IDD may predispose to footrot and the more extreme form of "super foul".

Clinical Signs And Aetiology

Foot rot (interdigital necrobacillosis) is a bacterial infection of the interdigital skin. Typically the epidermis is split to involve the underlying dermis and there is commonly an ascending cellulitis, leading to swelling from the coronet to the fetlock. The organisms isolated from naturally occurring lesions are Fusobacterium necrophorum and Bacteroides melaninogenicus (Berg & Loan 1975). These authors found that both organisms were necessary to reproduce the disease experimentally.

Experimental challenge followed scarification of the interdigital skin. However, Clark et al (1985) were able to reproduce foot rot by experimental cultures of F. necrophorum alone, although their experimental technique involved injecting *through* the interdigital skin and into the dermis. These results suggest that B. melaninogenicus initially penetrates the epidermis, providing access for F. necrophorum which produces the cellulitis leading to lameness. F. necrophorum and B. melaninogenicus also appear to act synergistically when in culture. Under natural conditions, interdigital skin would be exposed to B. melaninogenicus from faeces and hence simultaneous exposure to F. necrophorum could produce foot rot. However, it is interesting to note that in some of the cattle experimentally infected, only a mild superficial dermatitis was produced, without necrosis (Berg & Loan 1975). Today we would classify this as interdigital dermatitis (IDD). These mild lesions were only produced when an experimental culture of B. melaninogenicus and Actinomyces pyogenes was applied to scarified interdigital skin. Inclusion of F. necrophorum in the culture invariably appeared to lead to a necrotic lesion. The type of lesion produced by experimental inoculation therefore varies with:

1. The size of the inoculum.
2. The depth into the skin the inoculum is administered.
3. The concurrent presence of B. melaninogenicus.
4. The strain of F. necrophorum. Strains vary considerably in their pathogenicity

"Super Foul"

Over the past 1–2 years an apparently new type of foot rot has become of increasing importance in the UK (David 1993 and 1996, Cutler 1994). It is seen initially as a rapid onset of acute lameness with a swelling extending from the coronet to the pastern, forcing the claws apart. Within as little as 12 hours there may be severe interdigital damage, initially seen as skin rupture and haemorrhage and, later, extensive necrosis. The standard single dose of antibiotic (penicillin, oxytetracycline or ceftiofur) commonly used by UK dairy farmers to treat foot rot is certainly not adequate for "Super Foul". Very prompt and aggressive therapy continuing for 4–8 days is required, often at higher dose rates. Local treatment, for example, packing 2–4 capsules of an anti-anaerobe antibiotic such as clindamycin into the interdigital space is also commonly used (Cutler 1994). Even then, the outcome is not always successful, with some cows developing an uncontrollable, ascending cellulitis and others an interdigital prolapse of what appears to the be the navicular bursa, with continuous discharge of serous fluid. The savage onset of the lameness and the extent of the interdigital damage is striking. The limited cultural examinations which have been carried out have shown that some of the strains of F. necrophorum isolated from such cases are resistant to penicillin.

The term "super foul" is not particularly descriptive. As the organisms isolated appear to be identical to those causing normal interdigital necrobacillosis, probably the term "peracute foul" would be ideal.

Control Of Foot Rot

In the UK, the standard control measures for foot rot include:

1. Maintain clean passageways and fill holes in concrete, thereby reducing exposure of the feet to feces (and B. melaninogenicus).
2. Maintain as dry an environment as possible. The use of lime on cubicle beds will help to achieve this. Wet conditions soften interdigital skin.
3. Remove stones and other debris from gateways and repair rough floor surfaces, which could otherwise traumatise the interdigital skin, allowing the entry of F. necrophorum. Solid mud caused by frosty conditions can also cause skin damage and predispose to disease.
4. Use of a footbath (e.g. 5% formalin solutions) once a week, to clean and harden the interdigital skin.
5. Both F. necrophorum and B. melaninogenicus are gut organisms and hence faecal contamination is clearly of importance. When faced with an outbreak of foot-rot, some authors have suggested whole herd treatment with oral inorganic iodides (Greenough et al 1982), thereby decreasing the excretion rate of these organisms. Antibiotics such as chlortetracycline have also been suggested.
6. Prompt treatment of affected animals. Even in normal cases of foot-rot the "label" dose of penicillin is quite low and it has been suggested that this should be increased to three or four times the recommended level (Greenough, personal communication). Part of the problem seems to be that many manufacturers (in the UK at least) still refer to cows as weighing 400kg! Because of its zero milk withholding, Ceftiofur is being used increasingly in the UK as a treatment and provided that cases are treated early, seems to give a good response. In herds where there is a high incidence of digital dermatitis, herdsman treatment of "foot rot" might be delayed, because it is incorrectly assumed that lameness is due to dermatitis and not foot rot. This will also lead to a disappointing response to treatment.

These measures do not appear to control "Super Foul". A few herds have recently used

LincoSpectin footbaths, with some apparent success. However, it is difficult to assess their value accurately, because:

- The incidence of "Super Foul" is very variable, with only 1–2 cases occurring in some herds
- No controlled studies have been carried out.

LincoSpectin would also control DD and IDD. Could it be that IDD can act as the agent allowing penetration of F. necrophorum through the epidermis? It would appear that "Super Foul" occurs primarily in herds infected with IDD and DD (Cutler 1994).

Foot Rot And Interdigital Dermatitis

Clinically, it may be difficult to be sure if an interdigital lesion is an early case of foot rot (interdigital necrobacillosis), or a severe case of interdigital dermatitis (IDD). IDD lesions have three characteristics which make them more similar to digital dermatitis than to foot rot. These are:

1. Many cases of IDD have the pronounced foetid smell characteristically associated with DD. Toussaint Raven (1985) also makes specific reference to the characteristic smell associated with IDD.
2. With IDD there is no fissure in the epithelium and none of the dermal involvement one would expect to see with foot rot.
3. Most IDD lesions respond well to topical antibiotic aerosols. This would be expected with DD, whereas the treatment of foot rot requires parenteral therapy.

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