AABP FACT SHEET

INTERDIGITAL PHLEGMON (FOOT ROT)

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Interdigital phlegmon or foot rot is a mixed bacterial soft tissue infection of the foot of cattle which results in mild to severe lameness. Animals present with symmetrical swelling just proximal to the claw (Figure 1). In advanced cases, the swelling can extend a considerable way up the phalanges and tendons or joints may also become infected. Necrosis of the interdigital skin and a foul smell are classic characteristics of foot rot; however, in the early stages of infection the interdigital skin may be intact. The lesion must be differentiated from septic arthritis, which usually only involves the swelling of one digit.

Figure 1. A typical early foot rot lesion showing symmetrical swelling of the interdigital tissues and separation of the claws

Pathogenesis

The most common bacteria associated with foot rot are *Fusobacterium necrophorum* subspecies *necrophorum, Porphyromonas levii*, and *Prevotella intermedia* (the latter two formerly classified as subspecies of *Bacteriodes melaninogenicus*). The bacteria are all gram negative anaerobes that are present in the alimentary system of cattle and thus their environment. A defect in the interdigital skin allows opportunistic invasion by the bacteria which then cause inflammation and necrosis of the soft tissues of the digit.

Fusobacterium necrophorum produces a unique leukotoxin which induces apoptosis or lysis of bovine leukocytes. The virulence of *F. necrophorum* has been shown to be correlated to the quantity of leukotoxin produced. Other virulence factors produced by *F. necrophorum* are endotoxin, hemolysin and dermonecrotic toxin. *Porphyromonas levii* is poorly phagocytized by neutrophils and macrophages except in the presence of high concentrations of opsonizing immunoglobulin. *P. levii* produces an enzyme capable of degrading IgG_2 which is the primary opsonizing antibody. The role of *Prevotella intermedia* and other possible agents such as spirochetes in foot rot is unclear.

Once the bacteria gain entry to the tissues of the foot via a skin defect, they are well equipped to evade host defense mechanisms and establish infection. Proteases produced by the bacteria in conjunction with reactive products liberated from lysed leukocytes cause significant local tissue destruction. This creates an environment conducive to proliferation of the anaerobic bacterial population. The tissue destruction from the bacteria-host interaction leads to local swelling and pain.

A severe form of the disease has been recognized, termed 'super foot-rot', which is characterized by a per-acute onset, rapid and extreme necrosis and erosion of the interdigital space and refractoriness to treatment. It is believed that this form of the disease is due to an antibiotic resistant, virulent strain of *F. necrophorum*.

Other Predisposing Factors

The average annual incidence of foot rot in pastured cattle is 1–3% but the

Important Things to Know About Foot Rot

- Foot rot is a mixed, anaerobic bacterial infection of the soft tissue of the interdigital space.
- Infection causes significant tissue necrosis that can involve joints if left untreated.
- Lesions may be treated effectively with a range of parenteral antibiotics, provided they are administered early in the course of the disease.
- Control is by a combination of hygiene, footbathing, medication and vaccination.

Interdigital Phlegmon (Foot Rot) *continued*

variation between locations is large (range 0–36%). The average feeding period incidence in feedlot cattle is 1–5%, also with large variation (range 0–20%). Feedlots in the northern states tend to have higher incidence of foot rot than feedlots in southern states. Differences in incidence based on latitude are not reported for other production settings. In confined dairy cattle, the average annual incidence is 1.5–3.5%, with less variation between herds than for beef cattle.

In pastured cattle, rainfall is associated with increased incidence of foot rot. Mud in feed yard pens is considered an important risk factor. In confined settings, it may be more appropriate to discuss exposure to wet conditions than rainfall per se because cattle can create substantial mud holes near water troughs, shades, or feeders. The correlation between moisture and foot rot incidence is likely due to the effect of moisture on the survivability of the organisms and the propensity for damage to the interdigital skin following chronic wetting.

Treatment

Early detection is critical for successful treatment of foot rot **(Figure 2)**. The interdigital space should be debrided using a towel and antiseptic. Bandaging is unnecessary. Systemic antibiotics are always indicated for a period of 3–5 days. Fusbacterium necrophorum is susceptible to a wide variety of antibiotics including β-lactams, tetracyclines, macrolides, and sulfas; however, there are variations between studies regarding the proportion of isolates resistant to various antibiotics. In the US, ceftiofur, oxytetracycline, amoxicillin, and

Figure 2. A foot rot lesion that has progressed to necrosis of the interdigital skin

erythromycin are labeled for use. A treatment response rate of 70% can be expected with early detection. Animals commonly show significant improvement 2–4 days after treatment is initiated.

Advanced cases or cases of 'super footrot' with joint involvement may benefit from amputation of a digit if joint involvement is unilateral.

Use of a NSAID may be indicated for pain relief.

After-care

Animals should respond quickly to treatment and require minimal after care other than the provision of a clean dry comfortable area to rest.

Prevention

Hygiene is the most important control measure. Reducing exposure to manure and avoiding chronic wetting of the foot are paramount in reducing the risk of foot rot.

Frequency of manure removal from pens, freestall or corral design to maximize drainage, provision of dry lying and standing areas, and maintenance of watering and feeding areas to avoid mud accumulation are considerations for confinement operations.

Footbaths with a range of disinfectants will help clean and disinfect the interdigital skin and are discussed in depth in the *Digital Dermatitis Fact Sheet*.

Pasture operations should consider limiting access to known problem areas or using historically problematic pastures during dry weather if possible.

Ethylenediamine dihydriodide (EDDI) can reduce the incidence (by 60%) and severity of foot rot. A feeding rate of 0.11 mg EDDI/kg/day has been shown to be efficacious. Chlortetracycline has a label claim to aid in the prevention of foot rot when fed at 70 or 100 mg/head/day for animals up to 700 lbs and over 700 lbs bodyweight, respectively. No published efficacy data for chlortetracycline at the recommended feeding rate is available.

Vaccines containing inactivated *F. necrophorum* have label claims to aid in the prevention of foot rot in cattle. A 60–75% reduction in foot rot may be possible with these products. The leukotoxin of *F. necrophorum* is likely a critical component of these vaccines. However, the leukotoxin may be lost to protease degradation during production, therefore, products should have measurable levels of leukotoxin. AABP