

## **FOOT ROT, FOOT WARTS AND FOOTBATHS**

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### **Infectious Diseases of the Skin of the Foot**

Infectious disorders of the foot skin represent some of the most important causes of lameness in dairy cattle. However, unlike the lesion associated with a sole ulcer or white line disease which specifically affects the claw, these diseases affect the "skin" of the interdigital space, heel bulbs, and interdigital cleft (on the back of the foot above the interdigital space). Although there are some differences in the way these conditions develop and the way they appear, they all have at least one thing in common: they are believed to be caused by infectious agents capable of inducing inflammation and lameness.

### **Digital Dermatitis (Hairy Heel Warts or Footwarts)**

This disease has occurred in near epidemic proportions throughout North America since the early 1990s. Although not conclusively proven, it is the opinion of most that digital dermatitis (DD) is caused by 3, or possibly 5, different bacterial spirochetes belonging to the genus *Treponema sp.* Although lameness caused by DD may be severe, it tends to be an inconsistent feature of this disease. Florida studies indicate that only about half of the animals affected exhibit lameness. Cows naturally avoid contact with the ground or flooring surface by walking on their toes. In fact, stubbed toes and long heels from abnormal claw wear is one indicator of DD lesions. Despite obvious indications of discomfort, research indicates that cows affected with DD are likely to suffer reduced reproductive performance and a tendency for lower milk production.

Lesions associated with this disease are typically round or oval and located on the back of the foot adjacent to the interdigital cleft. Some lesions are located on or above the heel bulbs and still others may be found adjacent to or near the dew claws. Early lesions are red, raw, and flat. They are extremely sensitive and cows react painfully to spraying with water or other direct contact. Even a mild disturbance of the inflamed tissue tends to result in mild to moderate bleeding. As lesions mature most will enlarge and become thickened (more proliferative). Hairs at the skin margins are often long and erect. On close inspection mature lesions are similar to early lesions with a slightly more raised surface, characterized by some as granular or terrycloth-towel-like. These more mature lesions may be red, tan, or even grey. Similar to the early lesion, they are very sensitive and tend to bleed easily when touched or disturbed.

The natural way for skin or hoof horn to respond to chronic irritation is to increase its rate of growth. Consequently, the chronic lesions of DD are characterized by a thickening of the skin accompanied by the development of filamentous or conical (hair-like) projections of whitish, grey, or even brownish keratin (the tough protein substance of skin). These filamentous extrusions of skin are responsible for the characteristic hair-like appearance of some lesions and

thus, the term "hairy heel warts". Since hoof horn is a modified version of skin, lesions that develop near the site of hoof horn formation (near the coronary band) often have the effect of accelerating hoof formation and thus lead to overgrowth. Coincident with this is the fact that many of the bacteria believed to be associated with this condition are capable of producing enzymes which can eat away hoof horn. Therefore, it is not uncommon to find evidence of both claw horn overgrowth and heel horn erosion in the same foot.

### **Treatment of DD (Hairy Heel Warts. Footwarts)**

Approaches to therapy include: 1) surgical excision (removal), 2) footbaths 3) topical treatment with various disinfectants, caustic chemicals, and antibiotics, 4) cryosurgery (freezing), and electrocautery (burning), 5) topical treatment under a bandage, and 6) systemic antibiotic therapy. Some of these treatments have a place in management of this condition, however the less invasive forms of treatment are preferred by this author, and therefore are highlighted in the following.

Topical spray-on treatment with antibiotic and some non-antibiotic preparations has been shown to be very effective when used in a scheme of consistent daily treatment for a period of 8-10 days over 2-week period. The major disadvantage to topical treatment is that lesions occurring in the interdigital space are missed. Topical treatment under a bandage is particularly effective with most cows showing remarkable improvement within 24-48 hours. Furthermore, when properly applied this approach to treatment has the advantage of reaching interdigital lesions. Theoretically at least, the same is true for well-managed footbaths. Unfortunately, there are few published data on the effectiveness of footbaths for control of DD.

### **Interdigital dermatitis (Slurry Heel)**

Interdigital dermatitis (ID) is an acute or chronic inflammation of the interdigital skin, extending to the dermis. The disease is likely caused by a mixture of bacteria: *Fusobacterium necrophorum*, and bacterial spirochetes. In the early stages, ID is characterized by superficial erosion of the interdigital skin that some are able to recognize by its distinctive foul odor. The interdigital lesion is usually painful to the touch and followed by extension of the infection to the heel horn resulting in heel erosion, the most readily visible feature of this disease. Early-on, the eroded heel horn develops a pitted appearance. Eventually the roughened pitted heel horn is replaced by fissures (horizontal cracks) which may be sufficient to result in severe undermining of heel and solar horn. Coincident with this heel erosion is an acceleration of claw horn formation. Excessive claw horn formation leads to overgrowth and overloading of the affected claws. It's these effects of ID that are believed to make it an important predisposing cause of claw disease, particularly sole and heel ulcers.

Effects of ID on the interdigital skin are similar. Chronic inflammation causes the interdigital skin to thicken eventually resulting in the formation of an interdigital fibroma or "corn". The clinical diagnosis of ID is based on the presence of a thickened interdigital skin, pungent characteristic odor, pain to the touch, and the concurrent presence of heel horn erosion.

### **Treatment of ID**

Unlike DD, the lesions of ID are not readily accessible to treatment by topical spray. Topical treatment with antibiotic solutions or powder under a bandage are useful, but require removal of the wrap after 3-5 days. Footbaths are the likely the most practical option for treatment of interdigital lesions in cows. They are described in greater detail below.

### **Foot rot and Super Foot rot**

Footrot is an infectious disease of the interdigital skin characterized by the presence of an interdigital lesion, swelling, and moderate to severe lameness. Fever ranging from 103-105°F (occasionally higher) is a consistent finding during the acute stages. Although evidence is inconclusive, most believe that footrot develops following injury or abrasion of the interdigital skin. This interdigital injury is secondarily infected by *Fusobacterium necrophorum* alone, or in combination with *Bacteriodes melaninogenicus*, organisms which encourage progression to a more severe and necrotic-type of lesion. Failure to institute treatment early in the course of the disease may lead to complications involving the adjacent soft tissues (tendons, tendon sheaths, joint capsules, and bone) ultimately resulting in deep digital sepsis. At this stage, response to medical therapy is quite often unrewarding, thus limiting one's options to either surgery, or possibly euthanasia, in particularly severe cases.

In recent years, clinicians from the United Kingdom and the United States have observed a more extreme form of this disease referred to as "super foot rot". It is characterized by acute onset of lameness and swelling of the foot that progresses rapidly to an ascending cellulitis (a spreading infection). The interdigital lesion associated with this form of foot rot tends to be especially severe and successful treatment particularly challenging.

### ***Treatment of Foot rot***

Foot rot is responsive to most antibiotics in common use for cattle. In fact, dose and duration of treatment are likely more important than antibiotic selection. The key to achievement of a successful therapeutic outcome is dependent upon prompt recognition and early implementation of treatment procedures. Systemic antibiotic therapy plus topical treatment of the interdigital lesion have long been the preferred methods of treatment. In uncomplicated cases, improvement is noticeable within 24-48 hours with good recovery attainable in 3-4 days from the onset of treatment. Various antiseptic-type products may be used as topical treatments. Bandaging of the foot is unnecessary.

### **FOOTBATHS**

Footbaths are the traditional means to treat, control, and prevent foot problems on a herd basis. A quick review of the literature reveals that there is very little scientific information from which to draw ideas on where they should be placed, how big they should be, how often they should be used, how many cows can be treated before changing solutions, what compounds should be used to charge them or at what concentration? etc. Most of what we do with footbaths comes from someone's experience and clinical impressions. Therefore, information on footbaths must be interpreted and used carefully. Failure to do so has the potential to do more harm than good.

## **Indications for the Use of Footbaths**

The primary indications for footbath use are treatment, control and prevention of infectious disease problems that affect the skin of the foot: interdigital dermatitis (ID), foot rot, and digital dermatitis (DD), otherwise known as foot warts. Immersion of the foot into a medicated solution approximately 6 inches deep provides sufficient surface contact to treat skin lesions of the foot including those occurring in the proximity of the dewclaws as well as the interdigital space. Since the lesions of ID and foot rot commonly affect the skin in the interdigital space footbaths have long been recommended as the most practical approach to treatment and control of these conditions. Whereas, the majority of DD lesions occur on the back of the foot, (e.g. the heels or adjacent to the interdigital cleft) they are treatable by topical spray of various non-antibiotic and antibiotic solutions. Options for treatment of DD lesions occurring in the interdigital space are best managed by a well managed footbath or individual treatment procedures.

Laminitis, ulcers (toe, sole or heel), and white line disease are conditions in which footbathing has limited benefit. In fact, footbaths may actually be counterproductive in the management of these conditions where open lesions of the corium are present. The value of footbaths for management of claw horn lesions is secondary at best and related primarily to drying and hardening of the interdigital skin and claw horn. Indeed, clinical observation suggests that use of a footbath may deter bacterial infections of the foot skin and for that reason they are a popular form of herd lameness management. The benefits from skin or claw horn hardening from footbathing are less apparent and to these authors' knowledge not documented in the literature.

## **Types of Footbaths**

There are two types of footbaths: 1) stand-in or stationary, and 2) walk-through. Stationary footbaths are often constructed of concrete and positioned in milking parlor exit lanes. Portable systems made of fiberglass, rubber, or hard plastic have the advantage of being moved to locations more convenient for footbath use. Portable footbaths are particularly useful for individual treatment situations that may involve bathing of 1, 2 or all 4 feet of an animal for a prolonged period of time. Very large stationary footbaths are used by some to provide prolonged exposure of several animals to medicated solutions. For individual animals, a five gallon bucket filled with warm disinfectant solution serves the same purpose quite nicely. After a few treatments some cows will actually lift their leg and place it in the bucket with little effort required by the human assistant.

## **Disinfectants and Antimicrobials in Footbaths**

Walk-through footbaths containing 3 to 5 percent formalin, 5-10% copper sulfate, 10% zinc sulfate, or 1-10 gram per liter concentrations of antibiotics (tetracycline, oxytetracycline, lincomycin, or lincomycin/spectinomycin) are frequently recommended. Although efficacy of footbathing with these compounds is not well understood, there are certain precautions that should be considered. Formalin, for example may have some distinct advantages with respect to activity in the presence of organic matter, but it brings with it significant concerns for worker

safety that must be carefully considered before using it. Furthermore, when used in concentrations above 5%, potential for irritation and damage to the skin and foot exposed by disease or injury increases. For example, when corrective trimming procedures have exposed portions of the corium, repeated contact with irritating or caustic footbath solutions may damage delicate corium tissues and significantly complicate recovery.

With respect to antibiotic use in footbaths, readers are reminded that this represents extra-label drug use and must be done on the advice and under the direction of the herd's veterinarian. Although the likelihood of a residue occurring from use in a footbath is remote, potential always exists when antibiotics are used.

Copper sulfate is probably one of the most commonly used products in footbaths. Many have relied on it for years to manage foot rot and ID. In 1998 at the 10th International Lameness Symposium in Lucerne, Switzerland, Dr. Kempson and colleagues from Ireland reported on some rather disturbing findings from their studies on the effects of copper sulfate and manure slurry on hoof horn. Using a technique whereby they exposed small blocks of hoof horn to 5% copper sulfate, 5% formalin, and manure slurry they were able to observe the effects of these substances on the integrity of hoof horn. They found that exposure to the manure slurry and 5% copper sulfate increased the permeability of hoof horn leading to breakdown of the intercellular substance of hoof horn. These effects were not found in the formalin treated hoof sections. If these findings are indeed true and corroborated by further study, it may suggest concern for those who routinely use copper sulfate footbaths. It may also indicate that manure management has more important implications for hoof horn integrity and health than most have thought up till now.

### **Footbath Management Considerations**

*Location of the Footbath* Most are more familiar with walk-through type footbaths that are commonly located in the milking parlor exit lanes of loose housing systems. These are often permanently constructed into the floor, but as described earlier portable units have the advantage of being relocated as necessary. One of the disadvantages of locating footbaths in parlor exit lanes is that in some operations cows tend to loiter or otherwise get delayed in transit through these areas. When this occurs footbaths tend to become excessively contaminated and less effective. Walk-through footbaths are designed to allow cows to traverse the bath but not stand in it for prolonged periods. Under ideal conditions, once through the footbath(s) cows would proceed to a clean, dry area for approximately 15 to 30 minutes to maximize exposure of the feet to footbath solutions.

*Use of Pre-baths* Another technique that helps prolong the life of a medicated footbath is the use of a pre-bath which is placed ahead of the medicated bath. A study conducted at the University of Florida demonstrated that pre-baths do reduce contamination of medicated footbaths when used in a tandem arrangement. Therefore, one can extend the potential benefit of a footbath by using a pre-bath in tandem with a medicated footbath. Pre-baths may contain plain water or water with a small amount of mild detergent. The true value of adding detergents to a pre-bath is unknown. However, it is presumed by some that since most soaps and detergents have antibacterial as well as cleaning properties they may offer advantages over plain water

alone (assuming that they do not dilute or interfere with the antimicrobial properties of the medicated bath).

*Separating Cows or Groups of Cows for Footbathing* Some recommend separating the cows with specific footbath needs out from the rest of the herd. In theory, this makes good sense. The problem is that, logistically speaking, this is very difficult to accomplish on most dairies. And, cows which should be included with the footbath group are invariably not identified and denied footbath treatment only to show up at some later time with a more advanced problem. For example, cases of footwarts, interdigital dermatitis and footrot frequently go unobserved until they become relatively severe or cause lameness. Therefore, separation of cows into a specific footbath treatment group, while good from the footbath standpoint, may be very difficult from the standpoint of logistics and control of lameness in subclinically affected animals.

*Altering Cow Flow Through Footbaths* In general, the more cows that traverse through a footbath the more contaminated it gets. Consequently, the first cows (or first groups) through the footbath receive the benefit of freshest footbath solutions, whereas cows in the last groups are exposed to more contaminated solutions. In order to have all cows (or all groups of cows) eventually exposed to fresh solutions either the sequence of herds through the footbaths must be altered, or recharging of the footbaths must be timed accordingly. Either strategy requires extra effort but may be more convenient and less costly than frequent changing of footbath solutions.

*Housing, Management and Weather Conditions* Other factors that contribute to the contamination load in footbaths include: the housing system (i.e. pasture verses confinement), management decisions, and weather conditions. For example, feet of cows on pasture are usually cleaner than those of cows in confinement-type housing. Caking of manure and slurry on feet can be a significant problem in some housing systems depending in part upon the type of the stall or housing area bedding. This not only encourages infectious foot diseases but also increases the load of organic matter in footbaths. Likewise, overcrowding of barns generally encourages more exposure of feet to manure slurry. As indicated earlier, this not only has detrimental effects on hoof horn, but also increases problems with infectious foot disease problems.

Wet weather and muddy conditions keep feet moist and hoof horn softer. Such conditions also contribute significantly to footbath contamination problems for cows housed in dry lot or pasture conditions with heavily traveled cow lanes. Consequently, to reduce footbath contamination and prolong the useful life of footbath solutions in some herds requires improved manure management or more attention to the condition of cow lots and lanes.

*“Size Matters”* Some attempt to avoid problems related to contamination and neutralization of medicated solutions by constructing larger footbaths (obviously acting on the philosophy that “the solution to pollution is dilution”). One must remember that large footbaths take longer to fill, empty and clean, and it costs more to recharge them. Dr. Toussaint Raven in his book “Cattle Footcare and Claw Trimming” recommends the following dimensions for a walk-through footbath: 9 to 15 feet long, 3 feet wide and 6 inches deep. The volume of water held by a footbath in this size range is approximately 100 to 170 gallons of water. Clearly, footbath management by “dilution of the pollution” approach can be costly. On the other hand, footbaths

that are too small for herd conditions are more difficult to manage because of rapid neutralization by organic matter. The capacity (in gallons) of a rectangular footbath may be calculated by use of the following formula: Length (in feet) multiplied by, the Width (in feet) multiplied by, the Depth (in feet) multiplied by, a constant 7.46. To convert this to liters one need only multiply the total number of gallons by 3.8.

*Recharging Intervals* This brings us to the next question: How many cows can one expect to put through a footbath before it should be recharged? There is no good answer to this short of saying that every situation is different, and must be evaluated accordingly. In the Florida study referred to earlier, pH of a 60-gallon footbath containing a 1 gram per liter concentration of oxytetracycline changed significantly after only 50 or so cows had traversed the bath. A study by van Kuelen and co-workers on antibiotic footbaths found a 50% reduction in active drug following the passage of similar numbers of cows through a footbath. Serieys found that copper sulfate was rapidly neutralized by organic matter in footbaths. On the other hand, Greenough cites recommendations in his book "Lameness in Cattle" that suggests that as many as 300-800 cows may be treated with formalin footbaths before recharging. The bottom line is that contamination is the primary limiter of footbath effectiveness and it varies from farm to farm and it's difficult to make a uniform recommendation. However, based on available data (which is very limited) formalin appears to be the most resistant to neutralization by organic matter and probably lasts longest before re-charging.

*Footbath Frequency* The same difficulties occur when making recommendations on the frequency of footbath use. In general, when attempting to treat or control a problem one may consider near continuous use of a footbath. If prevention is the objective then a 2 to 3 times per week schedule may be sufficient. Raven suggests continuous use for confinement housing conditions and periodic use for pasture housing conditions.

### **In Summary,**

Clearly, there's more to the proper operation of a footbath than meets the eye. It's important to know where footbaths are indicated and likely to be of value. On the basis of present understanding they are likely of greatest benefit in the management of infectious foot diseases (foot rot, interdigital dermatitis, and papillomatous digital dermatitis). Readers are advised that there are some very important precautions to be aware of in using or recommending footbaths. Finally, note that footbaths require forethought and significant management effort. Unless they are utilized accordingly they may not only be of limited benefit, but may actually complicate the management of lameness conditions.

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