

Pathogenesis and Treatment of Sole Ulcers and White Line Disease

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KEYWORDS

- Cattle lameness • Laminitis • Sole ulcers • White line disease • Claw lesions
- Corrective trimming • Foot blocks

KEY POINTS

- Sole ulcers and white line disease are 2 of the most common claw horn lesions in cattle.
- Laminitis refers to a weakening of the suspensory apparatus of the third phalanx that predisposes to sole ulcers and white line disease.
- Risk factors for claw horn lesions include increased metalloproteinase enzymes and peripartum hormonal activity, cow comfort, prolonged standing on hard uneven walking surfaces, horn overgrowth, and claw conformation.
- Application of an orthopedic foot block and corrective trimming form the basis for successful treatment of sole ulcers and white line disease.
- Claw lesions heal by secondary intention requiring a range of 24 to 30 days for the reepithelization of an uncomplicated lesion.

Housing of dairy cows has changed over the past 50 years. Whereas cows were housed largely in stanchions and on pasture in years past, more than 75% of cows are housed in freestalls and drylot conditions. Performance has steadily improved as cows and herds have benefited from better feeding and management. Based on US Department of Agriculture statistics, dairy herds have also continued to get larger over the same period; in fact, over the past 4 decades the average herd size has increased from 29 to more than 187 cows per farm. Out of necessity, as herds have gotten larger, concrete has become the predominant flooring system. For a land animal like the dairy cow, these changes have come at a price. Cows housed in freestalls usually have a higher percentage of lameness, which most attribute to more time spent on concrete.

The authors have nothing to disclose.

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NONINFECTIOUS DISORDERS OF THE BOVINE FOOT

The most common causes of lameness affecting the cow's digit or claw are sole ulcers, white line disease (WLD), and traumatic lesions of the sole, including thin sole toe ulcers predisposed by thinning of the sole owing to excessive wear rates or over-trimming. Some of these conditions are predisposed by metabolic disorders, including rumen acidosis and laminitis, along with other physiologic changes that occur during the transition period. Nearly all are complicated by mechanical factors that are part of life on hard flooring surfaces that contribute to lameness by encouraging claw horn overgrowth and altered weight bearing. With few exceptions, sole ulcers and WLD are the most common claw disorders in confined dairy cattle.

THE DISTINCTION BETWEEN LAMINITIS AND CORIOSIS

Laminitis is an important underlying cause of sole ulcers and WLD; however, closer observation demonstrates that far more than just the suspensory tissues of the laminar corium are involved. The term coriosis better describes the condition as an inflammatory insult affecting the coronary, laminar, perioplic, and solar regions of the corium.¹ Involvement of the coronary corium accelerates the growth of wall horn; however, altered blood flow reduces keratinization of horn cells, making hoof walls weaker and abnormally deformed. Dorsal walls are often concave, and axial and abaxial walls flatten as they reach the weight-bearing surface. Coriosis also occurs as a subclinical disorder. Horn produced under these conditions is softer and may appear yellowish or reddish in color as a consequence of poor keratinization and staining by transudates that leak into the extravascular tissues during horn formation.

Laminitis better describes the physiologic or pathologic changes occurring to the laminar corium (suspensory apparatus of P3). In contrast with the horse, laminitis in cattle is primarily a degenerative rather than inflammatory process affecting the dermal-epidermal junction and basal cell layer of the epidermis. Inflammation may be largely a secondary event occurring subsequent to an increase in interstitial tissue pressure associated with the vascular events of vasodilatation, congestion, transudation, and diapedesis occurring within the corium.² Furthermore, despite its common association with rumen acidosis, few studies have been able to confirm a clear link between rumen acidosis and laminitis. Instead, weakness of the suspensory tissues of the third phalanx (P3) seem to bear a closer relationship with physiologic events occurring during the peripartum period. These are described in greater detail in the sections to follow.

LAMINITIS: PHASES 1, 2, AND 3

Laminitis occurs with greatest frequency during the peripartum period; however, the incidence of claw disorders often peaks at 100 plus days in lactation. Understanding laminitis as a 3-stage process helps to explain the temporal relationship between laminitis and claw lesions.

Laminitis is described as a disorder occurring in 3 distinct but overlapping phases.² Phase 1 is initiated by the release of vasoactive substances that impair blood flow to the corium and requires only a matter of hours to cause significant degeneration and damage to the dermal-epidermal junction. Phase 2 is characterized by the sinking and downward displacement of P3 that leads to compression-related injury of the corium and digital cushion beneath. Injury to the solar corium and digital cushion from compression causes hemorrhage, thrombosis, and variable amounts of necrosis, similar to that observed in phase 1, but in this case the lesion is a consequence of

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