

EPIDEMIOLOGY, PATHOGENESIS, DIAGNOSIS, AND TREATMENT OF LAMINITIS — ONE OF THE HOOF DISEASES IN CATTLE

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Annotation: This article comprehensively studies laminitis disease in cows, analyzing its epidemiology, etiology, pathogenesis, diagnostic methods, modern treatment approaches, and preventive measures. Within the scope of veterinary microbiology, mycology, virology, and immunology, the molecular and cellular mechanisms of the disease are also highlighted.

Keywords: laminitis, cows, inflammation, gout, immunology, diagnostics, physiotherapy, microbiology.

Annotatsiya: Mazkur maqolada sigirlarning laminit kasalligi keng qamrovli o'rganilib, uning epidemiologiyasi, etiologiyasi, patogenez, tashxis usullari, zamonaviy davolash va profilaktika choralari tahlil qilinadi. Veterinariya mikrobiologiyasi, mikologiyasi, virusologiyasi va immunologiyasi doirasida kasallikning molekulyar va hujayraviy darajadagi mexanizmlari ham yoritiladi.

Kalit so'zlar: laminit, sigirlar, yallig'lanish, podagra, immunologiya, diagnostika, fizioterapiya, mikrobiologiya.

Аннотация: В данной статье всесторонне изучается болезнь ламинита у коров, анализируются ее эпидемиология, этиология, патогенез, методы диагностики, современные методы лечения и профилактические меры. В рамках ветеринарной микробиологии, микологии, вирусологии и иммунологии освещаются молекулярные и клеточные механизмы развития заболевания.

Ключевые слова: ламинит, коровы, воспаление, подагра, иммунология, диагностика, физиотерапия, микробиология.

Introduction

Laminitis is a complex and painful disease that develops as a result of impaired blood circulation in the hoof tissues of cattle. The disease causes significant economic losses in the dairy and meat production industries. Research indicates that laminitis occurs in 10–15% of cattle and can reduce their productivity by 20–30%. This article provides a detailed overview of the causes, mechanisms of development, diagnosis, and treatment methods of laminitis.

Epidemiological Significance of Laminitis. Laminitis is commonly observed among livestock, especially under intensive feeding conditions such as on farms designed for high-

yield dairy cows. The disease is often associated with nutritional errors—particularly diets high in sugar or starch—excessive weight or load-bearing, and grazing on lush pastures. Outbreaks tend to be more frequent in specific groups, such as young cows or those that have calved multiple times.

According to global livestock statistics, laminitis most commonly affects large ruminants. The primary causes are improper feeding and poor zoohygienic conditions. Clinical studies confirm this: in Europe, signs of laminitis are found in 15 out of every 100 cows; in the United States, its prevalence in cattle farms is estimated at 10–12%; in Uzbekistan and Central Asia, this figure is estimated at around 8–10%.

Etiology of the Disease Improper Nutrition: Laminitis is most commonly associated with the consumption of feed rich in sugar or starch. For example, lush grasses and low-fiber diets, as well as feeds containing high levels of sugar and starch, can disrupt the digestive system of cattle, leading to the onset of laminitis.

Excess Weight or Obesity: Increased body weight is another significant factor in the development of laminitis. Obesity puts additional pressure on the shoulders, knees, and other joints, potentially initiating inflammatory processes in the limbs.

Hormonal and Metabolic Disorders: In certain cases, hormonal imbalances—particularly involving insulin—and disruptions in metabolic processes may also trigger laminitis. Metabolic diseases such as insulin resistance are considered among the primary causes of the condition.

Inflammation and Trauma: Inflammatory processes or physical trauma, whether localized in the limbs or occurring systemically throughout the body (e.g., joint pain or injuries), can provoke laminitis. In such cases, inflammation increases pressure on the hooves, contributing to the development of the disease.

Microbial and Infectious Agents: Certain bacterial or viral infections can also be responsible for the onset of laminitis. These pathogens or their toxins may reach the hooves via the bloodstream, causing inflammation and pain.

Heredity: Genetic predisposition plays a role in some forms of laminitis. Certain animals may be genetically more susceptible to developing the disease.

Pathogenesis of Laminitis. The pathogenesis of laminitis refers to the complex mechanism of its development and the physiological changes occurring within the organism. Laminitis is an inflammatory condition of the limbs that causes pain, swelling, and sensitivity in the tissues, with the main changes occurring in the pododerm (nervous and vascular systems) and surrounding structures. The development of the disease progresses through several key stages:

Metabolic and Inflammatory Processes: The onset of laminitis is often associated with metabolic disturbances. In particular, the consumption of feed high in sugars and starches (e.g., grains or high-energy rations) can disrupt insulin regulation in the animal's body. This results in elevated insulin levels and metabolic imbalance, which are among the leading triggers of laminitis.

Endotoxins and Microorganisms: Excessive sugar and starch intake may promote the growth of harmful microbial flora in the gut, leading to the release of endotoxins—byproducts of bacterial breakdown. These endotoxins enter the bloodstream and affect the microvascular system of the hooves. This results in inflammation and swelling of the blood vessels, which impairs blood flow and exacerbates the disease.

Changes in Hoof Structure: As laminitis progresses, the damage to the microvascular network within the hooves increases. This compromises the integrity of the lamellar tissues, leading to insufficient oxygen and nutrient supply. Consequently, necrosis may occur within these tissues, ultimately damaging the hoof structure.

Mechanical Alterations of the Hoof: With disease progression, laminitis disrupts the mechanical structure and function of the hoof. Inflammation and necrosis cause softening of tissues, weakening their ability to withstand mechanical stress. This leads to bone deformities, changes in connective tissues, and joint inflammation.

Structural Deformation of the Hoof: If left untreated, laminitis leads to severe structural changes in the hoof, including deformities in the lamellar tissue, bone structures, and joint function. The bones and joints of the hoof become increasingly sensitive, which severely impacts the animal's mobility. In the most severe cases, laminitis can result in total deformation or disintegration of bones, causing extreme difficulty in movement.

Microscopic Changes: At the microscopic level, laminitis involves alterations in the lamellar tissue, blood vessels, collagen fibers, and fibrin deposits. These changes occur due to high pressure and improper weight distribution. Histological examinations reveal collagen degradation and an increased presence of inflammatory cells, contributing to pain and structural changes in the tissue.

Cyclic Processes: During the course of laminitis, several cyclic processes develop involving hormones, metabolic activity, and microbial interactions. These processes reinforce one another, accelerating disease progression and necessitating precise and effective treatment strategies.

The pathogenesis of laminitis is a complex, multi-stage process involving metabolic, inflammatory, microvascular, and structural alterations. A comprehensive understanding of its development is crucial for effective prevention and treatment.

Diagnostic Methods. The diagnosis of laminitis involves several approaches, the most widely used of which include the following:

Clinical Examination: This method focuses on assessing the animal's general condition, body temperature, changes in gait, swelling, and redness in the limbs. Clinical examination helps detect the early signs of the disease, particularly during its initial stages.

Radiographic Diagnosis: Radiographic (X-ray) imaging allows for the identification of internal changes within the hoof matrix. This technique reveals structural deformities in the bones and other pathological alterations in the limbs, providing important information about the severity of laminitis.

Laboratory Analyses: Blood tests are conducted to detect signs of inflammation. Specifically, measuring levels of inflammatory markers such as C-reactive protein (CRP) and interleukins helps evaluate the progression and severity of the disease.

When used in combination, these diagnostic methods enable accurate and effective detection of laminitis, allowing for timely and targeted treatment interventions.

Treatment of Laminitis. The treatment of laminitis primarily focuses on reducing inflammation, relieving pain, minimizing hoof damage, and supporting the healing process. It

is essential to consult a veterinary professional, as each case requires an individualized treatment approach. In treating aseptic laminitis in cattle, combining traditional methods with pharmacological interventions has shown improved results. Specifically, intramuscular administration of 5 ml per 100 kg of body weight of 20% phenylbutazone on the first day, followed by 2.5 ml per 100 kg on the second day, has proven effective. While recovery in the control group treated with only traditional methods typically took 13–16 days, this combined approach reduced recovery time to approximately 10–11 days.

Modern veterinary services must be aimed at ensuring the health of livestock to achieve high-quality and abundant production or to maintain the well-being of service animals. Economic analysis of veterinary measures is crucial—it helps reduce disease incidence and mortality, enhance treatment effectiveness, shorten recovery time, and contribute to the development of healthy livestock herds.

The diversity of veterinary practices and their wide-ranging applications necessitate the development of comprehensive economic indicators to assess the effectiveness of veterinary specialists. This, in turn, supports the formulation of effective disease prevention strategies. Particular attention must be paid when developing preventive measures. Key preventative actions for laminitis include:

- Proper feeding practices and energy balance control
- Use of probiotics
- Annual veterinary checkups and laboratory screenings
- Improved zoohygienic conditions on farms
- Adjusting cattle diets and movement routines

Conclusion. Laminitis in cattle is a complex and serious disease, with its development influenced by various factors including improper feeding, obesity, metabolic disorders, and microbial activity. The pathogenesis of the disease involves inflammation of the microvascular system and tissue necrosis, leading to structural changes in the hooves.

Early diagnosis—through clinical examination, radiographic imaging, and laboratory testing—is essential. Treatment relies on conventional methods such as reducing inflammation, alleviating pain, protecting the hooves, and managing the diet.

Preventative measures and continuous veterinary supervision are vital for effective disease management. Early detection and appropriate treatment of laminitis play a significant role in maintaining overall herd health. Laminitis presents a serious threat to livestock farming, but with accurate diagnosis and proper preventive strategies, its impact can be significantly reduced. Compliance with feeding and care standards is critical in minimizing the spread of this condition.

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