CLINICAL COURSE AND PATHOGENETIC FORMS OF NECROBACTERIOSIS IN HIGH-YIELDING DAIRY CATTLE

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Abstract. *This study investigated the different clinical forms of necrobacteriosis and their pathogenetic characteristics in high-yielding dairy cattle. The research was conducted during 2024–2025 in three livestock farms located in the Yukori Chirchik district of the Tashkent region, Republic of Uzbekistan. Based on clinical observations, bacteriological analyses, and comparative evaluation methods, the course of the disease, localization of lesions, and degree of complications were comprehensively assessed.*

The results demonstrated that necrobacteriosis does not present as a uniform clinical condition, but varies depending on the localization of the pathological process, depth of tissue damage, involvement of microbial associations, and the immunobiological status of the host. It was established that the disease is not limited to hoof tissues alone, but may progress as a multi-stage infectious process involving the mammary gland and, in some cases, internal organs.

Based on the findings, the clinical course of necrobacteriosis was classified into three main pathogenetic forms: localized-destructive, complicated-associative, and generalized forms. The proposed classification is of significant practical importance for early diagnosis, assessment of disease severity, and selection of effective treatment strategies.

In addition, a set of clinical indicators with prognostic value for disease progression was identified. The multi-stage and polymorphic nature of necrobacteriosis suggests that it should be considered not merely as a local hoof pathology, but as a systemic infectious syndrome.

Keywords: *necrobacteriosis, cattle, Fusobacterium necrophorum, clinical forms, pathogenesis, hoof diseases, high-yielding dairy cattle.*

Introduction

Necrobacteriosis in cattle is one of the most widespread multifactorial diseases under modern intensive livestock production systems. Traditionally, this disease has been considered a localized infectious process primarily affecting the distal parts of the limbs. However, recent scientific evidence indicates that necrobacteriosis represents a complex, multi-stage syndrome with intricate pathogenetic mechanisms.

The principal etiological agent of necrobacteriosis is *Fusobacterium necrophorum*, which is frequently detected in association with other opportunistic microorganisms. The clinical manifestation of the disease is not uniform and varies depending on the localization of the pathological process, depth of tissue damage, involvement of microbial associations, and the immunobiological status of the host organism.

In high-yielding dairy cattle, intensive feeding practices, metabolic disturbances, and reduced immune resistance contribute to the development of severe and complicated forms of the disease. Under such conditions, the pathological process is not limited to hoof tissues, but may extend to the mammary gland and internal organs.

At the same time, there is no universally accepted, scientifically grounded classification of the different clinical forms of necrobacteriosis and their pathogenetic characteristics. This lack of a unified approach complicates early diagnosis and the development of effective treatment strategies.

The aim of this study was to investigate the clinical course and pathogenetic characteristics of necrobacteriosis in high-yielding dairy cattle and to develop a scientifically based classification of the disease.

Objectives

To achieve this aim, the following objectives were defined:

1. To identify different clinical forms of necrobacteriosis in high-yielding dairy cattle and assess their distribution patterns;
2. To analyze the clinical course of the disease depending on the localization of the pathological process and the depth of tissue damage;
3. To evaluate the role of microbial associations in the development and severity of necrobacteriosis;
4. To assess the dynamics of disease progression and the degree of complications in different clinical forms;
5. To determine the clinical and pathogenetic characteristics of necrobacteriosis involving the mammary gland and internal organs;
6. To substantiate the stage-wise patterns of disease progression;
7. To develop a pathogenetically grounded clinical classification of necrobacteriosis;
8. To identify key clinical indicators for predicting disease severity;
9. To develop scientifically based recommendations for early diagnosis and differential treatment.

Materials and methods

The study was conducted during 2024–2025 in livestock farms located in various regions of the Republic of Uzbekistan, including three dairy-specialized farms situated in the Yukori Chirchik district of the Tashkent region. High-yielding Holstein-Friesian dairy cows were selected as the primary study subjects.

A комплекс approach combining clinical and laboratory methods was applied to investigate the clinical course of necrobacteriosis in cattle. All animals underwent thorough clinical examination, during which lameness severity, morphological changes in hoof tissues, interdigital inflammation, necrotic lesions, and general clinical condition were assessed. Based on clinical findings, the animals were grouped according to the form and severity of the disease.

A total of 63 pathological samples were collected and analyzed under laboratory conditions. The samples were obtained aseptically from hoof lesions, interdigital soft tissues, and, in some cases, from the mammary gland and internal organs of forcibly slaughtered animals.

Bacteriological investigations were performed under anaerobic conditions. Kitt–Tarozzi medium and blood agar were used for cultivation. The samples were incubated at 37°C for 48–72 hours. The isolated microorganisms were identified based on their morphological, microscopic, and biochemical characteristics, and their identity as *Fusobacterium necrophorum* was confirmed.

The clinical course of the disease, localization of pathological processes, depth of tissue damage, and degree of complications were analyzed comparatively. In addition, the involvement of microbial associations and their influence on disease severity were evaluated.

The obtained data were processed using comparative analysis, generalization, and variational-statistical methods to ensure scientific validity.

Results

The results of the study demonstrated that the clinical course of necrobacteriosis in high-yielding dairy cattle is not uniform, but varies depending on the localization of the pathological process, the depth of tissue damage, the involvement of microbial associations, and the immunobiological status of the host.

During bacteriological investigations, anaerobic microorganisms were isolated from 80.0% (50 out of 63) of the collected pathological samples. Morphological and biochemical analyses confirmed that the majority of these isolates belonged to *Fusobacterium necrophorum*. In some cases, the microorganisms were detected in association with other opportunistic bacteria, which was considered one of the key factors contributing to the severity of the clinical course of the disease.

Clinical observations revealed that the most common form of necrobacteriosis was localized in the distal parts of the limbs. This form was characterized by a progressive development of inflammatory and necrotic processes. In the early stages, hyperemia, swelling, increased local temperature, and pain response were observed in the hoof area. Subsequently, disruption of skin integrity, serous and sero-hemorrhagic exudation, and the formation of superficial necrotic lesions were noted.

As the pathological process progressed, deep ulcerative-necrotic defects developed in the interdigital and sub-hoof tissues, with destructive changes becoming predominant.



Figure 1. Distal form of necrobacteriosis in cattle: deep ulcerative-necrotic lesions in the sub-hoof and interdigital tissues

Inflammatory and necrotic processes in the hoof tissues are clearly visible. A deep ulcerative defect with bloody exudate is observed in the sub-hoof region. The interdigital area shows contamination and the presence of purulent-necrotic masses, indicating the spread of the

pathological process into deeper tissues. This condition is characteristic of the complicated destructive stage of necrobacteriosis and represents a severe clinical form associated with microbial interactions.

In cases where purulent-necrotic microflora were involved, the disease course became significantly more severe, characterized by the discharge of purulent exudate from necrotic foci, formation of fistulas and abscesses, and partial separation of the hoof horn. In some cases, the pathological process extended to deeper structures, including tendons, muscles, and even bone tissues.

Although necrobacteriosis affecting the mammary gland was observed less frequently, it was characterized by a severe clinical course. Affected animals exhibited elevated body temperature (40–41^{0}C), reduced appetite, a marked decrease in milk production, and the formation of painful infiltrates within the mammary tissue. Pathological changes in milk, including abnormal admixtures and exudate, were also detected.

In cases involving internal organs, the disease manifested with signs of systemic intoxication, including apathy, tachycardia, tachypnea, and loss of appetite. These findings indicate the generalization of infection and the development of destructive changes in parenchymal organs.

Based on the obtained results, it was scientifically substantiated that necrobacteriosis in high-yielding dairy cattle follows a stage-wise progression. Initially, local inflammatory processes develop, followed by necrotic destruction and purulent complications associated with microbial interactions, and in severe cases, progression to generalized infection.

According to the findings, the clinical course of necrobacteriosis can be classified into the following pathogenetic forms:

- localized-destructive form;
- complicated-associative form;
- generalized form.

The proposed classification has significant practical importance for early diagnosis, assessment of disease severity, and selection of appropriate treatment strategies.

Discussion

The results of the present study demonstrate that necrobacteriosis in high-yielding dairy cattle represents a more complex and multi-stage pathological process than traditionally assumed. While most literature describes the disease as a localized infection confined to hoof tissues, the findings of this study confirm its systemic and polymorphic nature.

The clinical manifestation of the disease was found to depend primarily on the localization of the pathological process and the depth of tissue damage. Observations in the distal limb regions revealed a progression from inflammatory changes to necrotic destruction, supporting the concept of necrobacteriosis as a dynamic and progressive disease.

Bacteriological analysis showed that anaerobic microorganisms, predominantly Fusobacterium necrophorum, were isolated in 80.0% (50 out of 63) of the samples, confirming its leading etiological role. Additionally, the presence of microbial associations was associated with more severe and complicated forms of the disease, highlighting the importance of microbial synergy in pathogenesis.

The detection of systemic intoxication signs in cases involving the mammary gland and internal organs indicates the ability of necrobacteriosis to generalize. These findings support the

concept that the disease should not be regarded solely as a local pathology, but rather as a systemic infectious syndrome affecting the entire organism.

The pathogenetic classification proposed in this study—localized-destructive, complicated-associative, and generalized forms—has important clinical implications. It provides a practical framework for assessing disease severity, improving early diagnosis, and selecting differentiated treatment approaches.

Furthermore, the transition between clinical forms was found to be closely associated with farm management conditions, hygiene level, microtrauma, and the immune reactivity of animals. This emphasizes the critical importance of eliminating trigger factors in the prevention of necrobacteriosis.

Conclusions

Necrobacteriosis in high-yielding dairy cattle does not present as a uniform clinical condition; rather, it varies depending on the localization of the pathological process, the depth of tissue damage, and the involvement of microbial associations.

1. Bacteriological investigations revealed that *Fusobacterium necrophorum* was isolated in 80.0% (50 out of 63) of the samples, confirming its leading role in the etiology of the disease.
2. The clinical course of necrobacteriosis is characterized by a stage-wise progression, beginning with inflammatory changes, followed by necrotic destruction, and, in complicated cases, leading to generalized infection.
3. In cases involving the mammary gland and internal organs, the disease presents with a severe clinical course accompanied by systemic intoxication, indicating that necrobacteriosis should be regarded as a systemic infectious process.
4. The classification of necrobacteriosis into localized-destructive, complicated-associative, and generalized forms is clinically justified and facilitates early diagnosis as well as the selection of effective treatment strategies.
5. Disease severity is influenced by farm management conditions, hygiene level, microtrauma, and the immune reactivity of animals; therefore, elimination of these trigger factors is essential for effective prevention.

Practical recommendations

Regular clinical examinations of herds are recommended for early detection of necrobacteriosis, with particular attention to early signs such as hyperemia, swelling, and pain in the hoof region.

- Diagnosis should be based on a differential approach that takes into account the clinical forms of the disease (localized-destructive, complicated-associative, and generalized).
- Treatment strategies should be stage-based and comprehensive, including local antiseptic treatment, removal of necrotic tissues, and systemic therapy depending on disease severity.
- In cases of purulent-necrotic complications, antibacterial therapy should be selected based on the presence of microbial associations and applied in a scientifically justified manner.
- To prevent severe and generalized forms of necrobacteriosis, improvement of farm hygiene, regular hoof care, and implementation of preventive measures are essential.
- Elimination of trigger factors is of key importance in prevention, including balanced nutrition, improved flooring conditions, reduction of environmental moisture, and обеспечение adequate animal movement.

- In cases involving the mammary gland and internal organs, affected animals should be isolated and treated comprehensively to prevent the spread of infection.
- Implementation of a monitoring system for necrobacteriosis at the farm level is recommended, including systematic recording of disease cases and assessment of risk factors to improve preventive efficiency.

REFERENCES

1. Checkley S.E., Campbell J.R., Chirino-Trejo M., Janzen E.D. Efficacy of vaccination against *Fusobacterium necrophorum* infection for control of liver abscesses and footrot in feedlot cattle // Canadian Veterinary Journal. – 2005. – Vol. 46. – P. 1002–1007.
2. Nagaraja T.G., Lechtenberg K.F. Liver abscesses in feedlot cattle // Veterinary Clinics of North America: Food Animal Practice. – 2007. – Vol. 23, No. 2. – P. 351–369.
3. Smith B.P. Large Animal Internal Medicine. – 5th ed. – St. Louis: Elsevier, 2015. – 1712 p.
4. Radostits O.M., Gay C.C., Hinchcliff K.W., Constable P.D. Veterinary Medicine: A textbook of the diseases of cattle, horses, sheep, pigs and goats. – 10th ed. – Saunders Elsevier, 2007. – 2065 p.
5. Quinn P.J., Markey B.K., Leonard F.C., FitzPatrick E.S., Fanning S., Hartigan P.J. Veterinary Microbiology and Microbial Disease. – 2nd ed. – Wiley-Blackwell, 2011. – 928 p.
6. Blowey R., Weaver A. Color Atlas of Diseases and Disorders of Cattle. – 3rd ed. – Mosby Elsevier, 2011. – 240 p.
7. Greenough P.R. Bovine laminitis and lameness // Veterinary Clinics of North America: Food Animal Practice. – 2007. – Vol. 23, No. 2. – P. 331–350.
8. Berg J.N., Scanlan C.M. Studies of *Fusobacterium necrophorum* from bovine hepatic abscesses: biotypes, virulence, and antibiotic susceptibility // American Journal of Veterinary Research. – 1982. – Vol. 43, No. 9. – P. 1580–1586.
9. Tan Z.L., Nagaraja T.G., Chengappa M.M. Selective enumeration of *Fusobacterium necrophorum* from bovine ruminal and fecal samples // Journal of Microbiological Methods. – 1994. – Vol. 19. – P. 33–39.
10. Narayanan S.K., Nagaraja T.G., Wallace N., Staats J., Chengappa M.M. Biochemical and virulence characteristics of *Fusobacterium necrophorum* isolates from bovine hepatic abscesses // Anaerobe. – 2002. – Vol. 8, No. 2. – P. 89–95.