

Conference Paper

Therapeutic Effectiveness of an Antiseptic Drug for Ulcerative Finger Lesions in Artiodactyls

Tatyana Leshchenko¹, Irina Mikhailova¹, Alexey Yevglevsky², Evgeniy Finageev¹, Maya Finageeva¹, and Olesya Mikhailova³

¹Vocational Education Program, “Don State Agrarian University” Rostov Oblast, Russia

²Vocational Education Program, “Kursk state agricultural Academy named after I. I. Ivanova” Kursk Oblast, Russia

³Vocational Education Program, “Rostov Oblast Station of Animal Disease Control” Rostov-on-Don, Russia

ORCID:

Tatyana Leshchenko: <http://orcid.org/0000-0001-9894-9326>

Abstract

The most common surgical pathology of cattle and small ruminants is purulo-necrotic disease in the hoof, which is caused by deep neurotic-dystrophic disorders and is the result of exposure to exogenous and endogenous factors, as well as inadequate, monotonous feeding and non-compliance with hygienic and quarantine measures. The success of the control of purulent-necrotic processes in the area of the hoof depends on the timely detection of sick animals, their correct treatment and effective preventative work. Scientists have proposed many approaches and methods for treating animals that have hoof diseases, but there is no consensus about the effectiveness of the existing drugs. For the treatment of cattle and small ruminants with purulo-necrotic disease of the hoof, we proposed a new antiseptic drug with bacteriostatic, fungicidal, astringent and regenerating effects. This drug contains copper sulfate, boric acid and succinic acid. It is applied as a powder. The healing of the purulo-necrotic ulcers in the experimental animals occurred under a fibrin-tissue scab, and by the 10th day, the abnormal focus was filled with granulations followed by epithelization, which was explained by the energetic metabolic effect on the cells of the succinic acid included in the drug. The advantage of the proposed method of treatment is in the simplicity of the technical preparation of the powder under the conditions of production and in the rapid recovery of animals. The powder does not possess inhibitory properties and does not have a toxic effect.

Keywords: cows, sheep, ulcers, treatment, new powder

Corresponding Author:

Alexey Yevglevsky
olnimix@mail.ru

Published: 5 April 2021

Publishing services provided by
Knowledge E

© Tatyana Leshchenko

et al. This article is distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use and redistribution provided that the original author and source are credited.

Selection and Peer-review under the responsibility of the DonAgro Conference Committee.

 OPEN ACCESS

1. Introduction

Nowadays the main direction of the agrarian policy of the Russian Federation is a comprehensive and steady increase of farming sector, the intensification of agricultural

production, its transfer to industrial basis and the acceleration of the scientific and technological progress of the industry [1]. In this regard, the key direction in the development of cattle and sheep breeding is the increase of the productivity of animals and reduction of the cost of milk and meat production [2]. However, this is hampered by the incidence of diseases of non-infectious etiology of animals, which still remains at a high level. According to veterinary reports, up to 80% of the total number of animals with surgical pathology is the diseases of distal segment of limbs [3].

In recent years, purulo-necrotic deceases of fingers in cattle and small ruminants, which are caused by deep neurotic-dystrophic disorders and are the result of exposure to exogenous and endogenous factors (mechanical damage: wounds, compression, repeated bruises, prolonged maceration, the introduction of keratolytic and pyogenic microflora), as well as inadequate, monotonous feeding and non-compliance with zoohygienic and quarantine measures. [3, 4]. These diseases cause great economic damage to livestock breeding complex [5, 6].

N.S. Ostrovsky [7], during trauma and maceration of the skin of the fingers in cattle and small ruminants, established primary clinical forms of the disease indicating surgical infection: purulent, putrefactive and anaerobic, including causative agents of necrobacillosis and foot rot. The passage of microorganisms occurs in the absence of appropriate treatment of animals, which complicates the course of the disease [8, 9]. With timely and correct treatment, the ulcerative surface is uniformly filled with healthy granulations and recovery can occur within 2-3 weeks. In this case, the prognosis is positive. Without treatment, ulcers do not heal for a long time, which is primarily due to their slow self-cleaning from necrotic tissues and poor epithelialization [10, 11] The success of the control over purulo-necrotic processes of fingers depends on the timely detection of sick animals, their correct treatment and effective preventive activities [12.13] Different authors have different approaches to the treatment of purulo-necrotic diseases of fingers. However, they recommend carrying out primary surgical treatment, removing dead tissue to the borders with healthy ones [2]. The detached hoof horn must also be removed, which improves the course of the pathological process [14, 15] During the treatment of purulo-necrotic deceases of fingers in cattle and small ruminants, N.S. Ostrovsky [7] recommends the use of potassium permanganate powder with boric acid, other authors locally use furacilin, polymyxin M, tetracycline, biomycin, etc. V.M. Rukol successfully uses chelate compounds [16], M.M. Aleksin uses Cephased drug [17], E.V. Khovailo used Ligurol-Derma for the treatment of ulcerative lesions of the hooves of cattle [18] Alsaad M. used ketoprofen to relieve pain in cows with limb pathology [19]. Thus, at the present stage of the development of cattle and sheep breeding, the

development and introduction of new drugs and methods of treatment for diseases of the distal segment remains urgent and is of great practical importance.

2. Methods and Equipment

2.1. Methods

The research was performed on the basis of dairy units and sheep-breeding farms in the Rostov region. The objects of research were cows with an average weight of 500-600 kg and adult sheep.

During the surgical clinical examination, animals with purulo-necrotic disease of fingers were identified.

In order to compare the effectiveness of the proposed method for the treatment of ulcerative process of fingers of large and small ruminants, 30 sick cows of Red Steppe and Black-and-white breeds at the age of 4-7 years and 30 sheep at the age of 1 to 2 years were selected. From this livestock, 3 groups of each animal species were formed.

After the animals were fixed, we carried out thorough mechanical cleaning and surgical treatment of the lesion, then the detached horn, necrotic tissues and effusions were completely removed, bleeding was stopped by tamponing, the surface of the defect was dried, and powdered drugs were applied. Then a protective bandage was applied, saturating it with birch tar. Subsequent treatment of sick animals consisted of dressing change after 3-5 days, depending on the severity of the pathological process, until the defect is healed completely.

After surgical treatment of the animals of the first (control) group we applied a drug containing potassium permanganate - 50 g, boric acid - 50 g (powder by N.S. Ostrovsky) on the ulcer surface.

After surgical treatment of the animals of the second (experimental) group we applied a drug containing copper sulfate - 50 g, boric acid - 50 g. on ulcerative defects in the area of fingers.

The animals of the third (experimental) group received a drug containing copper sulfate - 50 g, boric acid - 40 g, succinic acid - 10 g.

Hematological studies were carried out on the basis of the Millerovsky branch in the Rostov regional veterinary laboratory.



Figure 1: Taking blood from rams

3. Results

The gravest course was in the cases of purulo-necrotic processes developing under the stratum corneum and in the skin of the interdigital fissure with the appearance of erosions covered with gray-white sticky effusions, focal putrefactive decay of the hoof horn. The space between the grown horny walls and soles was found, it contained: effusions, tissue residues, the smallest particles of manure and feed. We noted the unevenness of the thickness of elongated horny wall with a dull, rough surface, gradually taking the shape of a curved tube.



Figure 2: Detachment of the hoof wall and ulcer of the horn of the sole in a sheep

If the primary ulcers were located in the area of the torus, then we observed detachment of the horny plate of the torus, sole, and then the back section of the inner wall. Between the stratum corneum and the hairy areas of the skin, a narrow gap formed, from which, a liquid effusion was released when the sole was pressed. After removing a part of the stratum corneum, white and pink ulcers of various sizes and shapes with eroded edges were noticed against the background of a new, subcorneous layer of the epidermis. The injuries and maceration of the skin led to the introduction of microbes that intensified inflammatory processes in the lesion.

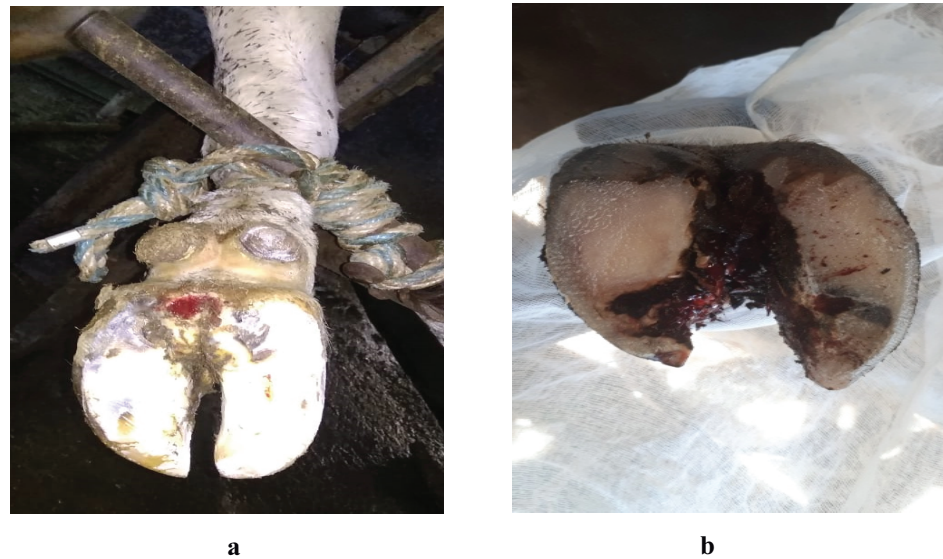


Figure 3: Ulcer of the torus of the fourth finger (a) and the interdigital skin fold (b)

As it is known, the physiological state of the hoof horn depends on the livestock management, full feeding and timely trimming of the grown horn cleft. The pasture conditions for keeping animals contribute to the qualitative development of the horny capsule of the hoof. Here, the main role is played by mineral and green dressing, active exercise, optimal soil condition (moisture, consistency, salt composition). When animals move, blood circulation in the distal part of limbs increases, tissue nutrition improves, which has a positive effect on the usefulness of horn formation, especially on its growth in the longitudinal direction from the coronet to the sole. However, during the period of stall keeping of animals, optimal conditions can not be created, therefore, the number of cases increases.

We took blood from sick animals for hematological study.

TABLE 1: Hematological indicators of animals with ulcers in finger area

Indicators	Control group (n=10)	Experimental group (n=10)
Hemoglobin, (g/l)	90,40± 0,15	91,10± 0,12
Erythrocytes, (10 ¹² /l)	5,70 ± 0,13	6,50± 0,13
Leukocytes (10 ⁹ /l)	20,80± 0,22	19,90± 0,18***
ESR (mm / hour)	1,20± 0,22	1,10± 0,18***

During the general study of blood, we found that in the lower limits of physiological fluctuations there were indicators of the number of erythrocytes. The number of erythrocytes was 5.70 ± 0.13 in the control group and 6.50 ± 0.13 10¹² / l in the experiment group, the hemoglobin level was 90.40 ± 0, 15 and 91.10 ± 0.12 g / l, respectively, they were less than the lower values, and the indicators of the number of leukocytes and

MCV were higher than the upper values of physiological fluctuations: leukocytes were 20.80 ± 0.22 in the control and $19.90 \pm 0, 18^{***}$ g / l ($P < 0.001$) in the experiment groups; MCB in the control group increased to 1.20 ± 0.22 and in the experiment to $1.10 \pm 0.18^{***}$ mm / hour ($P < 0.001$), which indicated the presence of an inflammatory process, namely, purulo-necrotic tissue lesions of fingers.

The treatment of animals with purulo-necrotic lesions of fingers is a labor-intensive and time-consuming process.

We used three different drugs in the experiment. We applied powder to the ulcerative surface of sick animals of the control group according to Ostrovsky N.S. The defect healed under a fibrinous tissue scab, the growth of granulations was observed after 7-8 days with an uneven coating of the defect surface. Healing of purulo-necrotic ulcers in animals of this group occurred on average on the 21st days.

For the animals of the second (experimental) group we used the following powder: copper sulfate - 50 g, boric acid - 50 g. Healing was under a fibrinous tissue scab, the appearance of single granulations was noted in 5-6 days with an uneven coverage of the defect surface. During palpation, they bleed easily. Healing of purulo-necrotic ulcers in this group occurred on the 18th day.



Figure 4: Antiseptic powder

We used new antiseptic drug for the animals of the third experimental group. During the first change of the dressing we noted the formation of fibrinous tissue scab and fine-grained granulations of a bright red color, dense consistency and the appearance of an epidermal rim on the surface of the ulcer. During the next days of treatment, the surface of the ulcer decreased in size and by the 10th day epithelization of the defect was observed (Tables 2 and 3).

As a result of the experiment, it was found that the healing of the abnormal focus of animals using the antiseptic powder containing copper sulfate, boric and succinic acids occurred in a shorter time compared to the previously proposed methods of treatment.

TABLE 2: Stages of healing of purulo-necrotic ulcers in the fingers of cattle and small ruminants

Indicators	Groups of animals		
	Control	Experimental 1	Experimental 2
Appearance of granulations, days	7,0±1,12	6, 0 ±1,13	3,10±0,79
The filling of the defect with granulation tissue, days	11,00 ±,05	10,00 ±2,04	6,00 ± 1,54
Epithelialization of the defect, days	21,00± 2,30	18,00± 2,10	10,00 ± 1,40

TABLE 3: Effectiveness of treatment of large and small cattle with finger diseases

Group	Number of animals	Medicinal product	Duration of treatment, days	Number of treatments	Recovered, heads
1.	20	Powder by Ostrovsky N.S.	21±2	7	20
2.	20	Copper sulfate and boric acid powder	18±2	6	20
3.	20	Antiseptic powder (copper sulfate, boric and succinic acid)	10±1	3	20

During the course of clinical studies, the healing of purulo-necrotic ulcers in experimental animals occurred under a fibrinous tissue scab, the filling of the defect with granulations followed by epithelization was completed by the 10th day, which is explained by the energetic metabolic effect of succinic acid on the cells.

4. Conclusion

According to the research results, the number of treatment days (10 days) decreases in the experiment and the number of treatments (3 days) decrease. In the control group, the treatment was carried out for 21 days. During this period, 7 treatments were carried out. The recovery of animals in the experimental group was 10 days faster, while their general condition significantly improved.

Analyzing the results of the treatment of cows and sheep with ulcerative process in the area of the fingers, we conclude that the proposed antiseptic drug showed its high therapeutic efficiency. In our opinion, this is due to the mechanism of action of the components included in this antiseptic product. Its use accelerates the healing of

the defect due to the regenerating action of succinic acid, bacteriostatic and fungicidal action of copper sulfate, bacteriostatic and astringent action of boric acid. It reduces the number of treatments and the duration of the course of treatment.

The results of clinical study of the new antiseptic drug allow recommending it for the use in production conditions for the treatment of wound and ulcerative processes in the area of the fingers of cattle and small ruminants.

Thus, the proposed method for the treatment of sheep with purulo-necrotic lesions of the fingers using a new antiseptic powder of local action showed its high therapeutic efficiency and the simplicity of its production in industrial complex allows obtaining and using the drug in the required rate.

Conflict of Interest

The authors have no conflict of interest to declare.

References

- [1] Mikhailova, I. I. (2020). Approach to the Treatment of Cows with the Diseases of the Distal Part of the Extremities. *International Journal of Psychosocial Rehabilitation* vol. 24, issue 5, pp. 4526-4539.
- [2] Mikhailova, I. I. (2020). Monitoring of surgical Pathology of Fingers in Cattle in the Farms of the Rostov region *Bulletin of Michurinsky GAU*, vol. 1, issue 60, pp. 184-189.
- [3] Zhurba, V. A. (2009). Causes of Diseases of the Distal Part of the Extremities in Highly Productive Cows. *Modern technologies of agricultural production: materials of the XII International Scientific and Practical Conference*. Grodno: Grodno State Agrarian University. **vol. 1 pp. 435-436**
- [4] Knappe-Poindecker, M., et al. (2013), Interdigital dermatitis, heel horn erosion, and digital dermatitis in 14 Norwegian dairy herds. *Journal of Dairy Science*, vol. 96(12): p. 7617-29.
- [5] Pisarenko, V. F. (2014). Study of the Prevalence of Treponema-Borrelia-Infections, Accompanied by the Development of Digital Dermatitis in the Farms of the Belgorod Region. *Bulletin of the Kursk State Agricultural Academy*, **vol. 1**, issue 1 pp. 71-72.
- [6] Cruz, C., et al. (2001) Bovine Digital Dermatitis in Southern Brazil. *Vet The Veterinary record* **148(18)**: Rec., issue 148, pp. 576-577.
- [7] Ostrovsky, N. S. (1981). Prevention of Diseases of the Fingers of Cattle. *Veterinary Medicine*, vol. 1, pp. 65-67.

- [8] Capion, N. (2012). Infection Dynamics of Digital Dermatitis in First-Lactation Holstein Cows in an Infected Herd. *Journal of Dairy Science*, vol. 95, pp. 6457–6464.
- [9] Capion, N., *et al.* (2013). A Study into Digital Dermatitis. *Open Journal of Veterinary Medicine*. **Vol. 3 issue. 2, pp. 192-198.**
- [10] Alsaad, M., Fadul, M. and Steiner, A. (2019). Automatic Lameness Detection in Cattle. *The Veterinary Journal*, issue 246, pp. 35–44.
- [11] Lopatin, S. V. and Samolovov, A. A. (2015). Digital Dermatitis. *Animal Husbandry of Russia*, vol. 3. pp. 85-86.
- [12] Eliseev, A. N. (2012). Combined Method of Treating Cows in Conditions of Dairy Complexes with Putrefactive and Purulent-Necrotic Lesions of Finger Tissues. *Bulletin of the Kursk State Agricultural Academy*, vol. 1, pp. 112-113.
- [13] Kirillov, A. A. (2007). Complex Method of Treatment of Cows with Purulent Pododermatitis. (PhD thesis. Saint-Petersburg State Academy of Veterinary Medicine).
- [14] Barwick, J., *et al.* (2018). Predicting Lameness in Sheep Activity using Triaxial Acceleration Signals. *Animals (Basel)*, vol. 8 (1), <https://doi.org/10.3390/ani8010012>
- [15] Chapinal, N., *et al.* (2009). Using Gait Score, Walking Speed, and Lying Behavior to Detect Hoof Lesions in Dairy Cows. *Journal of Dairy Science*, vol. 92, pp. 4365–4374.
- [16] Rukol, V. M. (2013). Application of the Drug “Biochelate-Spray” for the Treatment of Cows with Diseases of the Fingers. *Scientific Notes of the UO VGAVM*, vol. 50, issue 1, pp. 139-141.
- [17] Alesin, M. M. (2014). Therapeutic Efficacy of the Combined Use of the Antimicrobial Drug “Cefased” and the Vitamin-Mineral Complex “Multivit + Minerals” for Purulent Pododermatitis in Cows and the Veterinary and Sanitary Characteristics of Milk Against the Background of their Use. *Uchenye Zapiski UO VGAVM.*, vol. 50, issue 2, pp. 120-124.
- [18] Khovailo, E. V. (2015). Clinical and Morphological Evaluation of the Effectiveness of the Drug “Ligurol-Derma” in the Treatment of Ulcerative Lesions of the Hooves of Cattle. *Scientific notes of the UO VGAVM*, vol. 51, issue 1, pp. 149-153.
- [19] Alsaad, M., *et al.* (2019). Use of Validated Objective Methods of Locomotion Characteristics and Weight Distribution for Evaluating the Efficacy of Ketoprofen for Alleviating Pain in Cows with Limb Pathologies. *PLoS One* vol. 14(6) art. e0218546.