A clinical trial to assess the use of sodium hypochlorite and oxytetracycline on the healing of digital dermatitis lesions in cattle

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Abstract — The increased frequency of diseases, especially those of the hoof, cause economic losses, such as premature culling of affected animals, decreased milk production, weight loss, reduced fertility, and the high costs of treatment. A great variety of hoof conditions may affect cattle, one of them is digital dermatitis. These conditions are probably due to multiple factorial diseases and present with similar clinical signs. Bovine lameness is typically treated by foot trimming and debridment of the lesions, coupled when necessary with systemic antibiotics and therapeutic footbaths, which results in a clinical cure in the majority of the cases. The objective of this study was to evaluate the topical action of sodium hypochlorite associated with the systemic use of oxytetracycline for the treatment of wounds clinically diagnosed as bovine digital dermatitis. One hundred and twenty Holstein cattle varying ages from 1 to 9 y and presenting the clinical signs of digital dermatitis, were used in this study. Group 1 (G1) received topical treatment with a 1% sodium hypochlorite footbath twice a day for 30 d and 4 treatments of parenteral oxytetracycline (10 mg/kg bodyweight, IM, q48h). Group 2 (G2) received only the topical treatment with 1% sodium hypochlorite, as described for G1. Group 3 (G3) received only with parenteral oxytetracycline, as described for G1. Group 4 (G4) was treated exclusively with a dicloro divynil pirrolidona, ortoiododimetil, para-nitofenil-fosforotioato in a vegetal tar-based ointment, immediately after the surgery. After 45 d, the recovery rates were as follows: G1, 86.67%; G2, 73.33%; G3, 56.67%; and G4, 50%. The surgical treatment of digital dermatitis with subsequent treatment with oxytetracycline systemically and 1% sodium hypochlorite topically was the most effective for the convalescence of cattle bearing wounds similar to digital dermatitis.

Résumé — Essai clinique en vue d'évaluer l'efficacité de l'hypocholorure de sodium et de l'oxytétracycline dans la guérison des lésions de dermatite interdigitée chez les bovins. Une augmentation de la fréquence des maladies, particulièrement celles du sabot, conduit à des pertes financières causées par l'élimination précoce des sujets atteints, la diminution de la production laitière, la perte de poids, la réduction de la fertilité et les coûts élevés du traitement. Plusieurs pathologies du sabot, dont la dermatite interdigitée, peuvent affecter les bovins. Ces affections sont probablement reliées à des maladies à causes multiples et présentent des signes cliniques semblables. La boiterie des bovins est traitée habituellement par la taille des sabots et le débridement des lésions, associés si nécessaire à une antibiothérapie systémique et à des bains de pieds thérapeutiques, ce qui conduit à une guérison clinique dans la majorité des cas. L'objectif de cette étude était d'évaluer l'action topique de l'hypochlorite de sodium (eau de javel) associée à l'oxytétraxycline systémique dans le traitement de plaies dont le diagnostic clinique était la dermatite interdigitée. Cent vint bovins Holstein dont l'âge variait de 1 à 9 ans et qui présentaient des signes cliniques de dermatite interdigitée ont fait partie de l'étude. Le groupe 1 (GI) a reçu un traitement topique comprenant un bain de pieds contenant 1 % d'hypochlorite de sodium 2 fois par jour pendant 30 jours et 4 traitements à l'oxytétracycline par voie parentérale (10 mg/kg de poids corporel, IM, q 48 h.). Le groupe 2 (G2) a reçu uniquement le traitement topique à l'hypochlorite de sodium à 1 % tel que décrit pour le groupe G1. Le groupe 3 (G3) a reçu uniquement l'oxytétracycline parentérale tel que décrit pour le groupe G1. Le groupe 4 (G4) a été traité exclusivement avec un onguent à base de goudron végétal

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contenant du dichlorodivinyl pyrrolidone, de l'orthoiododiméthyl et du paranitophényl-phosphorothioate immédiatement après la chirurgie. Après 45 jours, les taux de guérison étaient respectivement de 86,67 %, de 73,33 %, de 56,67 % et de 50 % pour les groupes 1, 2, 3, et 4. Le traitement chirurgical de la dermatite interdigitée suivie d'oxytétracycline systémique et de bains de pieds à l'hypochlorite de sodium à 1 % était le plus efficace pour les bovins présentant des lésions ressemblant à de la dermatite interdigitée.

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Introduction

In response to the world's demand for animal products, animal production, such as milk from cattle, has become intensified. This usually results in a decrease in animal welfare, leading to an increased frequency of diseases, including those of the hoof.

The major economic costs incurred because of lameness in cattle are premature culling of affected animals, decreased milk production, weight loss, reduced fertility rates, and the high costs of treatments (1–3).

A great variety of hoof conditions can affect cattle, one of them is digital dermatitis. These conditions are probably multifactorial and show similar clinical signs. Some conditions may be complicated, leading to more severe problems and thus preserving a complicating factor for determining the initial etiology (4).

Digital dermatitis, or hairy heel, is one of the most common hoof conditions seen in cattle (5–7). It was first described in the early 70s as being a highly contagious condition, with ulcerative and proliferating lesions on the bulb and heel or in the interdigital space (8,9).

Digital dermatitis is thought to be an infectious disease due to its tendency to disseminate in the herd (10). The etiologic agents have not been completely elucidated, (10,11), which complicates the finding of a successful treatment protocol. Spiral bacteria, similar to spirochetes, and probably of the genus *Treponema,* have been associated with this condition (12–15).

Debridement combined with footbaths and systemic use of antibiotics is a procedure that usually leads to curing the lameness in most animals (3,6,16). Among the antibiotics, oxytetracycline is commonly employed, because it has a wide spectrum of action (17). Hypochlorites posses a wide spectrum of action against bacteria, fungi, and viruses (18). In veterinary medicine, sodium hypochlorite is employed for antisepsis of the hoof and for "predipping," "postdipping," and disinfection of milking equipment at concentrations of 2% to 4% of active chlorine (19). A search of the literature has not found reference to the use of sodium hypochlorite in bovine footbaths (18,20–22). However, the topical use of hypochlorite on the interdigital space has been reported (23).

Although there are different treatments for bovine lameness, most are expensive and not always effective, and they require specialized personnel. The objective of this study was to evaluate the topical action of sodium hypochlorite in combination with systemic tetracycline on the postoperative care of wounds clinically diagnosed as bovine digital dermatitis.

Material and methods

This research was conducted in 2 rural properties of semiextensive breeding activity from January 2000 to March 2001. One hundred and twenty Holstein animals, 1 to 9 years of age and presenting with clinical signs of digital dermatitis, were used.

All of the lesions were categorized into initial or advanced stages, based on visual characterization. The initial stage appeared as extremely sensitive, red, round lesions close to the bulb of the heel or in the region between the heels on both the fore and hind limbs. In the most advanced stage, the affected area was observed to be larger and swollen, with superficial necrotic areas and sole detachment, heel erosion, presence of hair (fur), growth of verrucous tissue, and, often, destruction of a great part of the stratum corneum.

The animals were restrained in tie stalls used for hoof cleaning; IV regional anesthesia (24) was induced with 2% lidocaine hydrochloride (Pearson anaesthetic; Pearson Saúde Animal, Rio de Janeiro, Rio de Janeiro, Brazil), each hoof was cleaned and trimmed, whether it was healthy or not, and any lesions were debrided. The surgical treatment involved the removal of all necrotic tissues, granulomas, and any remaining compromised tissues, even from the stratum corneum. The same method of restraint in tie stalls was employed for the clinical examination at the end of the study.

After the debridement, the animals were divided into 2 groups, considering the stage (initial or advanced) of the lesion. Then, they were randomly divided into 4 groups of 30, based on the treatment to be received postoperatively, provided that each group received an equal number of animals from the 2 categorized groups of lesions.

Group 1 (G1) received local topical treatment with 1% sodium hypochlorite (Sodium Hipochlorite; Casa forte, Goiânia, Goiás, Brazil) in a footbath, q12h for 30 d, and systemic treatment with oxytetracycline (OxtratLA; Vallée S/A Produtos Veterinários, Montes Claros, Minas Gerais, Brazil), 10 mg/kg bodyweight (BW), IV, q48h for 4 applications. Group 2 (G2) received only topical treatment with 1% sodium hypochlorite, as described for G1. Group 3 (G3) received only systemic oxytetracycline, as used in G1. Group 4 (G4) was treated exclusively with dicloro divynil pirrolidona, ortoiododimetil, para-nitofenil-fosforotioato in a vegetal tar-based ointment (Miosthal; Minerthal, São Paulo, São Paulo, Brazil), immediately after the debridment. All animals received a single dose of 0.2 mg/kg BW of abamectine (Lancer; Vallée S/A Produtos Veterinários, Montes Claros, Minas Gerais, Brazil) for the purpose of preventing larvae infestation. A control (no-treatment) group was not included, because, at present, there is no known spontaneous recovery of the condition. During the study, all of the milk from cows treated with parenteral oxytetracycline was discarded.

The footbath consisted of 2 compartments; the 1st compartment contained only water and was intended

Table 1. Results obtained in 120 Holstein cattle on rural properties with digital dermatitis after 4 different postoperative treatments, from January 2000 until March 2001

Groups	Number of animals	Animals	
		Recovered	Non recovered
G 1	30	26 (86.67%)	4 (13.33%)
G 2	30	22 (73.33%)	8 (26.67%)
G 3	30	17 (56.67%)	13 (43.33%)
G 4	30	15 (50%)	15 (50%)
Total	120	—	—

G 1 (Group 1) — Topical and systemic treatment; G 2 (Group 2) — Topical treatment; G 3 (Group 3) — Systemic treatment; G 4 (Group 4) — No treatment

for cleansing the feet before the cows entered the 2nd compartment, which contained the sanitizing solution. The sanitizing solution was changed after the passage of 120 animals or after 3 d (whichever came first), based on previous successful experience (23). Both microbiologic and chemical analyses showed a decrease in chlorine concentrations day after day; however, it was reported that the hypochlorite solution contains active chlorine in effective concentration for up to 3 d in the footbath or for the passage of 150 animals (25).

At the end of the study, 45 d after debridement, one (not blinded) clinical examination of the hoof was done. Clinically, an animal was considered as recovered if after 45 d of treatment neither wounds nor inflammatory processes, sensitivity to palpation, edema, and hyperemia of the injured area were present, denoting complete healing or epithelialization of more than 75% of the lesion. Animals considered not to have recovered had moderately inflammatory lesions, sensitivity to palpation, edema, hyperemia, reappearance of necrotic areas, larvae infestation, lameness, and healing process $\leq$ 75% of the affected area.

The data were analyzed by the χ^2 test (26), where each animal was considered the experimental unit.

Results

The tie stall restraint and local anesthesia employed permitted a satisfactory clinical evaluation and debridement.

On initial clinical examination 72 animals (60%) had initial stage lesions, and 48 animals (40%) had advanced stage lesions. The surgery associated with hoof cleaning removed all the necrotic and devitalized tissue, which hypothetically facilitated tissue airing and recovery.

Forty-five days after debridement, the results for each group were as follows: 26 (86.67%) animals from group 1, 22 (73.33%) from group 2, 17 (56.67%) from group 3, and 15 (50%) from group 4 were considered recovered (Table 1), (the numbers in brackets refer to the percentage of animals from each group).

There was a significant difference ($P = 0.011$) among the 4 tested treatment groups, where the $\chi^2_{calculated} = 11.10 > \chi^2_{.05(3)} = 7.81$ (Table 1).

Discussion

The clinical signs observed in the 120 cows in this present study were similar to those reported in the literature

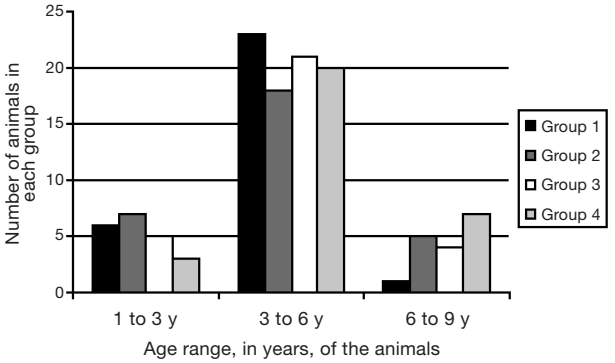

Figure 1. Occurrence of clinical lesions of digital dermatitis, according to age range, on 120 Holstein cows, on rural properties, given 4 different treatments, from January 2000 until March 2001.

G 1 (Group 1) — Topical and systemic treatment; G 2 (Group 2) — Topical treatment; G 3 (Group 3) — Systemic treatment; G 4 (Group 4) — No treatment

for digital dermatitis (13,27–29). Depending on the intensity of the injury, irritability of the interdigital space may cause discomfort to the animals, possibly due to the great sensitivity of the injured area, leading to a preference for lying down. This favors a reduction in food intake, thus causing weight loss, fertility rate reduction, and diminished production of both milk and meat (1,2), of up to 20% and 25%, respectively (3).

Among other pedal conditions of cattle (5–7), digital dermatitis has been widely observed in our environment. The debridement of digital wounds, as done on this study, has led to good results, especially when associated with topical or parenteral use of other medication. The positive results obtained by the treatment performed on group 1, when debridement was combined with oxytetracycline parenterally and sodium hypochlorite in a footbath, confirmed the effectiveness of the adopted procedures. Several authors have also recommended such procedures for obtaining good results for cattle with foot conditions (3,6,16).

There are strong reasons for believing that digital dermatitis is an infectious condition that is highly contagious, of complex etiopathogenesis, and of multifactorial origin (4,8,9). Therefore, it was considered essential to use the systemic action of a wide spectrum antibiotic, such as oxytetracycline, during the postdebridement period (18). The sodium hypochlorite-based sanitizing solution was selected because of its action on fungi, viruses, and bacteria (18,21) and advantages of low cost, low toxicity, and fast sanitary action (18,30)

The use of sodium hypochlorite has some disadvantages, such as tissue irritation (on animals or personnel), low stability for storage, and the interference of organic material on its action (20,29).

The results indicated that sodium hypochlorite is more efficient in the treatment of lesions similar to bovine digital dermatitis when it is combined with debridement and parenteral use of oxytetracycline. Its positive effect was also observed even when used alone, presumably due to the sanitizing action of the product on contaminated wounds. The bactericidal action of sodium hypochlorite has already been reported (19), as well as the maintenance of chlorine concentrations on the solution

during a given period of time (25). The isolated use of the antibiotic was not enough to fight the local infectious process, despite the benefits inferred from the surgical cleansing of the injured area. Therefore, we assume that the concomitant use of topical bactericide is of great importance.

As the prevalence of digital dermatitis increases on a property, treatments combining surgery with topical and parenteral use of medication might become expensive (3,7). Nevertheless, in this study, a greater number of animals recovered in the group where a combination of treatments was employed. CVJ

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