

## COMPARISON OF CEFTIOFUR SODIUM BY INTRAVENOUS REGIONAL ANTIBIOTHERAPY AND LOCAL OXYTETRACYCLINE APPLICATION FOR TREATMENT OF BOVINE DIGITAL DERMATITIS

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**Summary:** In the study, it was aimed to evaluate effects of ceftiofur sodium on bovine digital dermatitis lesions and its comparison to topical oxytetracycline HCl application. Simmental breed of dairy cows (n=30) suffering from digital dermatitis were used in the study. Animals were allocated into 3 groups. Group 1 (n=10) was premedicated by administration of xylazine HCl. 400 mg of ceftiofur sodium combined with 15 ml of local analgesic (lidocaine HCl) was injected into Vena digitalis dorsalis communis III or V digitalis palmaris communis IV (Intravenous regional antibiotherapy - IVREGAB). Feet of group 2 (n=10) were locally sprayed with oxytetracycline for 3 days with 2 days intervals and group 3 (n=10) was applied only saline solution. In group 1, four cows showed no sign of lesion after 3 days of application, therefore the treatment was discontinued. In remaining six cows, IVREGAB was repeated. In group 2, healing was slow and needed 3 more applications. In group 3, there were no apparent healing but papillomatous form developed. It was concluded that the application of ceftiofur sodium by IVREGAB for the treatment of bovine digital dermatitis in individuals provided quick and reliable healing in comparison to local oxytetracycline applications in this study. Because of negligible withdrawal time, ceftiofur sodium may be the first choice for the treatment of near-market animals suffering from digital dermatitis.

**Key words:** Digital dermatitis, treatment, ceftiofur sodium, oxytetracycline.

### Sığırda Dermatit Digital'in Tedavisinde Seftiyofur Sodyumun İntravenöz Regional Antibiyoterapisi ve Lokal Oksitetrasiklin Uygulamalarının Karşılaştırılması

**Özet:** Çalışmada seftiyofur sodyum'un sığır digital dermatitis lezyonları üzerine etkisi ve topikal oksitetrasiklin HCl uygulaması ile karşılaştırılmasının değerlendirilmesi amaçlandı. Çalışma kapsamına digital dermatitis belirtisi gösteren Simental ırkı süt inekleri (n=30) dahil edildi. Hayvanlar 3 gruba ayrıldı. Grup 1 (n=10) ksilazin HCl enjeksiyonu ile sedasyona alındı. Dört yüz mg seftiyofur sodyum 15 ml lokal anesteziyle (lidocain HCl) karıştırılarak Vena digitalis dorsalis communis III veya V digitalis palmaris communis IV'e enjekte edildi (Intravenous regional antibiotherapy - IVREGAB). İkinci gruptaki (n=10) hayvanların ayaklarına lokal olarak oksitetrasiklin sprey şeklinde 2 gün aralıklarla 3 gün uygulandı. Grup 3 (n=10) sadece serum fizyolojik ile muamele edildi. Grup 1'de uygulamayı takip eden 3. günde 4 inekte lezyon belirtisi kayboldu. Bu nedenle tedaviye devam edilmedi; kalan 6 inekte ise IVREGAB tekrarlandı. Grup 2'de iyileşmenin yavaş olması nedeniyle 3 uygulama daha yapıldı. Grup 3'te iyileşme olmadı, fakat; papillomatöz karakterli lezyonlar gelişti. Sonuç olarak, bovin digital dermatitis tedavisinde seftiyofur sodyumun IVREGAB uygulaması lokal oksitetrasiklin uygulamalarına kıyasla daha çabuk ve güvenilir iyileşme sağladı. Ette veya sütte gözardı edilecek düzeyde birikmesinden dolayı seftiyofur sodyum, tüketime sunulacak digital dermatitli hayvanlarda ilk seçenek olarak tercih edilebilir.

**Anahtar sözcükler:** Digital dermatitis, tedavi, seftiyofur sodyum, oksitetrasiklin.

### INTRODUCTION

Bovine digital dermatitis (BDD) is a diffuse or sometimes circumscribed superficial epidermitis of the bovine digit at the coronary margin and commonly occurs at the plantar or palmar aspect of the interdigital space just above the cleft, midway between heel bulbs<sup>1,2</sup>. BDD was first reported in Italian dairy cows<sup>3</sup>. The economic importance of the disease cannot be ignored since it is responsible for the significant decline of milk production<sup>4</sup>. The aetio-pathogenesis of BDD has received much more attention recently, with objective of identifying specific micro-organisms associated with the disease. However, there has been a continuing controversy, whether BDD is a disease following a primary infection or is secondary to other predisposing factors. Successful isolation of spirochaetes from lesions<sup>5-7</sup> have encouraged researchers to focus on the role of

these organisms in the disease's aetiology.

BDD responds well to topical antibacterial treatment. Local applications of oxytetracycline and lincomycin-spectinomycin were often used for the treatment of BDD<sup>8,9</sup>. In contrast, parenteral treatment with penicillin, streptomycin, tetracycline, cephalixin and sulphonamides have all been attempted but none were found particularly effective in UK dairy cattle practice<sup>1</sup>.

To treat infection on a herd basis, footbaths have been advocated as an easy, effective method<sup>10,11</sup>. Correct claw trimming has strongly been advocated to be an adjunct to all treatments<sup>12</sup>.

Ceftiofur sodium is a third-generation cephalosporin (a class of  $\beta$ -lactam antibiotic) and has been approved for using in cows<sup>13</sup>. It is usually highly

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resistant  $\beta$ -lactamase enzymes. It has a bactericidal effect in vitro and inhibits transpeptidation, which is required for bacterial cell wall peptidoglycan synthesis<sup>14</sup>.

In all treatment policies for the control or eradication of BDD infections, the main obstacle is to provide the satisfactory levels of antibacteriocity into deeper layer of the tissues i.e. lesions. Therefore, it was proposed that the administration of antimicrobials by intravenous route (intravenous regional antibiotherapy-IVREGAB), may supply desired concentration of antibacteriocity to the lesion sites<sup>15</sup>.

The purpose of the study reported here was to evaluate the IVREGAB application of ceftiofur sodium for the treatment of BDD seen in Turkish dairy cows and to compare the efficacy of ceftiofur sodium with that of oxytetracycline, which has been widely used for the treatment of BDD.

#### MATERIALS and METHODS

**Cows:** Thirty Simmental breeds of cows were selected for the study. They were suffering from severe lameness and the lesions were consistent with the description of digital dermatitis lesions<sup>3</sup>. They were located at the plantar aspect of the feet, proximal to the interdigital cleft between the heels. Animals were allocated into 3 groups each consisting of 10 cows. Group 1 was selected for the IVREGAB study. Group 2 was nominated for the application of topical oxytetracycline HCl while group 3 was allocated as control population in which only saline solution was locally applied. Animals were aged between 3 and 10 years.

**Group 1:** To sedate animals, xylazine HCl (0.5-1 mg/kg) was administered by intramuscular route. Animals were positioned in lateral recumbency employing Reuff technique with effected feet suspending upper. Feet was washed with pressurized tap water, clipped and disinfected by povidine iodine solution. A garo was applied to just below the tarsal joints to display Vena digitalis dorsalis communis III or V digitalis palmaris communis IV. The needle (20-25 gauge, 2.5 inch) was inserted to the vein and allowed approximately 20 ml of the venous blood flow out freely (Figure 1).

400 mg of Ceftiofur sodium (Exenel, Eczacibasi, Turkey) was added to 15 ml of lidocaine (Jetokain 2% Adeka, Turkey). This combination was slowly (i.e. within 20 seconds) administered to the



**Figure 1.** Cannulation of v. digitalis dorsalis communis III (third foot).

**Resim 1.** V. digitalis dorsalis communis (arka ayak) kanülasyonu.



**Figure 2.** Administration of ceftiofur sodium.

**Resim 2.** Seftiyofur sodyum'un verilışı.

corresponding vein (Figure 2).

Feet were checked whether analgesia was achieved and then necrotic tissues were removed. Claws were trimmed where necessary. The garo was left for 30



minutes in its place. Finally, cows were released.

*Group 2:* Feet were washed and dried. According to the manufacturer's instruction, oxytetracycline (Terramycin Vet Sprey, Pfizer, Istanbul, Turkey) was sprayed locally on the lesions. This procedure was repeated every other day for 3 days.

*Group 3:* Feet were cleaned as in group 2. Approximately 100 ml of saline solution was applied on the surface of the lesion by means of a pressurized pulverisator for 3 days with 2 days intervals.

*Biopsy:* Full thickness of skin tissue from the lesion was obtained by a punch and placed into 10% formalin solution for histopathological evaluation. Haematoxylin and Eosin staining (H&E) technique was used. Following days, animals were monitored for the sign of improvement of locomotion and healing of the lesions.

## RESULTS

The lesions were predominantly located on the hind feet and sized 1-2 cm in diameter with ulcerative changes. There was severe pain in touch, and wound was bled easily when manipulated. Staining of digital dermatitis skin tissues with H&E revealed superficial erosion restricted to the epidermis and around rete ridge formations. Cytoplasmic swelling and vacuolation was present in epidermal cells together with an intense neutrophilic leukocyte exocytosis. The necrotic epidermis often contained a heavy bacterial colonisation that included cocci, coccobacilli and spirochaetes (data not shown).

On day 3, four cows in the group 1 showed significant recovery and these were discharged and treatment was discontinued. They showed no sign of lameness and the quality of feet was satisfactory. The rest of the feet displayed slight lesions in this group, therefore IVREGAB was re-applied. After 3 days, cows were re-examined and no detectable lesions were observed (Figure 3a and b). The locomotion of these cows improved from good to excellent.

In the group 2, healing was slower than group 1 therefore procedure had to be repeated for 3 more times and then 8 cows displayed healing and good locomotion. But two animals did not improve despite rigorous treatment and remained chronically lame.

Animals of group 3 did not showed any significant recovery although lesions turned into papillomatous form and became less sensitive to vigorous manipulation.



**Figure 3a.** Appearance of digital dermatitis lesion (Before treatment).

**Resim 3a.** Digital dermatitis lezyonunun görünüşü (Tedaviden önce).



**Figure 3b.** Appearance of digital dermatitis lesion (After treatment with ceftiofur sodium).

**Resim 3b.** Digital dermatitis lezyonunun görünüşü (Seftiyofur sodyumla tedaviden sonra).

## DISCUSSION

Although clinical and histopathological characteristics of BDD have been well documented<sup>16</sup> the eradication of the disease still not practical in dairy industries.



In this study intravenous use of ceftiofur sodium for the treatment of BDD showed desirable healing. No side effects were observed such as pain or phlebitis on the injection site. Animals were tolerated the dosage well with showing no vomiting, nausea or diarrhoea. Field observations indicated that ceftiofur administered intramuscularly was effective for treating digital dermatitis<sup>17</sup> but three or more consecutive applications may needed to be repeated.

Ceftiofur sodium showed a superior effect in comparison to oxytetracycline application on BDD lesions. Oxytetracycline HCl had to be applied 3 or more times. This may cause losses of financial cost, time and labour that are spent by either clinicians or farmers. In addition, the environmental contamination due to use of local oxytetracycline HCl could be another concern.

Failure of local oxytetracycline HCl application for the treatment of BDD may be explained as; a) spray form of the drug may not supply sufficient antibacterial level in the lesion, b) re-contamination may occur because BDD is an open wound/lesion, c) antibacterials are removed from the lesion surface by grass or surface content, d) antibacterial concentration is decreased by debris when cow moves around, and e) penetration of the oxytetracycline HCl into the deeper layer of the skin remains debatable, therefore these issues have to be closely studied.

It was reported that intravenous administration of ceftiofur sodium provides desired amount of antibacterial concentration in the soft tissues<sup>15</sup>. To this end, because BDD is a soft tissue inflammation, at least we believe that, ceftiofur sodium can reach enough antibactericidal in the lesion.

Cephalosporins are particularly useful for treating infections of soft tissue and bone due to bacteria that are resistant to other commonly used antibiotics and they are relatively non-toxic. For this reason, it can be used in animals intended for human consumption<sup>13</sup>.

The striking increase in incidence of BDD, associated with the relative failure of current treatment strategies such as local application of oxytetracycline HCl is worrying. The data generated in this study serves as a basis to justify further aggressive approaches to analysis of the disease and attempts at prevention and treatment.

Precise aetiology of BDD is still under construction and primary cause should be fully investigated including re-infection studies. The current authors hope that the data provided here may be useful for future investigations in regard with its treatment and control i.e. vaccination.

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