

Foot Disorders in Dairy Cows - Treatment with Regional Perfusion with Ceftiofur Sodium

Felipe Gomes Soares[✉], José Victor Marques de Carvalho[✉], Isadora Carvalho Leite[✉],
Vinícius Silveira Raposo[✉] & Cândice Mara Bertonha[✉]

ABSTRACT

Background: Foot disorders represent important economic losses in dairy cow farming due to reduced productivity, high treatment costs, changes in farm handling, and disposal of milk and animals. Thus, there is a need for treatment options with lower and efficient costs that do not require milk disposal. Ceftiofur sodium is one of the few antimicrobial options considered to be residue-free in milk, with positive results in the treatment of foot disorders. This study aimed to report on the use of regional perfusion with ceftiofur sodium to treat foot disorders in dairy cows.

Cases: From February to April 2023, by evaluating a herd of 100 dairy cows (Holstein Friesian x Gyr) raised in a semi-extensive system in the region of Serra da Canastra, 4 cows were found to have foot disorders, presenting interdigital dermatitis (n = 1), sole hemorrhage and double sole (n = 1), and interdigital hyperplasia (n = 2). The animals received treatment with a single regional infusion of ceftiofur sodium. The procedure began with restraining the animals in a hoof trimmer, performing trichotomy and antisepsis of the common dorsal digital vein, and placing a rubber tourniquet around the proximal metacarpal or metatarsal region. Venipuncture was performed with a scalp vein infusion set (19G needle) to administer lidocaine hydrochloride and ceftiofur sodium. The tourniquet was kept on for 30 min to allow regional perfusion of the antimicrobial. This allowed for the necessary time to surgically debride the lesions, apply a dressing, and provide analgesic and anti-inflammatory treatment before releasing the animals back to their original enclosure. The wound dressings were changed on a weekly basis and the wounds were cleansed with running water and neutral soap to keep them dry and clean. Copper sulfate was included in the 1st 2 dressings to facilitate debridement of the wounds. The locomotion score (LSC) and body condition score (BCS) were assessed weekly to monitor the animals' recovery. The LSC scored high in the initial assessments but returned to normal at the end of treatment, whereas the BCS displayed slight fluctuations during this period. Milk yield was estimated by 3 weighings before lesions appeared until recovery, indicating a consistent decrease in milk yield over time. The animals' recovery period lasted from 4 to 7 weeks, and expenditures were tabulated to assess the average cost of treatment, which amounted to BRL 185.70 per animal, considering only the expenses from medicines and materials.

Discussion: The treatment of foot disorders in cows using regional perfusion with ceftiofur sodium showed satisfactory results, promoting the recovery of animals, in line with published studies. There are few studies that report the cost of treating foot disorders in cows and most of them present outdated figures, making it difficult to compare values. The decline in milk production without recovery after treatment should not solely be attributed to foot issues, but also to the environmental challenges due to high rainfall rates. The absence of ceftiofur sodium residue in the milk allowed for its preservation during treatment, avoiding reductions in farm income and the need for modifications, such as changing the milking process and different disposal of the milk from the treated cows. Finally, the treatment of foot disorders in dairy cows by regional perfusion with ceftiofur sodium showed satisfactory results, at an affordable price, promoting the recovery of the animals, without the need to dispose of milk or change the handling of the farm, minimizing losses.

Keywords: antibiotic, treatment, bovine, hoof, cost.

DOI: 10.22456/1679-9216.136440

Received: 27 November 2023

Accepted: 2 March 2024

Published: 29 April 2024

Federal Institute of Education, Science, and Technology of Minas Gerais, Bambuí Campus, Bambuí, MG, Brazil. CORRESPONDENCE: F.G. Soares [felipegomesmedvet@gmail.com] & C.M. Bertonha [candice.bertonha@ifmg.edu.br]. Fazenda Varginha - Rodovia Bambuí/Medeiros - Km 05. Caixa Postal 05. CEP 38.900-000 Bambuí, MG, Brazil.

INTRODUCTION

Foot disorders are among the main problems faced by dairy cow farmers. They are triggered by environmental or inherent factors [15,16] and culminate in lameness, resulting in reduced movement, feed intake and milk production [5]. These alterations result in an increase in the locomotion score (LCS), a decrease in the body condition score (BCS), and a reduction in farm income [5,1].

Treatment can vary according to the disorder and severity of the case, with the use of antimicrobials associated with surgery being the most effective method [2,8]. However, most antimicrobials release residues in milk, posing a severe problem for public health and industries since most of the time this milk is not disposed properly [9].

Ceftiofur sodium is one of the few antimicrobial options that does not require milk disposal [3]. Moreover, it can be used in regional perfusion, which consists of administering the drug at low doses to the distal part of the injured limb, resulting in higher plasma concentrations at the specific injury site when compared to systemic administration, providing satisfactory results with lower costs and risks [3,10,14].

There are few studies reporting on the use of treatment based on regional perfusion with ceftiofur sodium, as well as information on its efficacy, cost, and recovery time. This study aimed to report on the use of regional perfusion with ceftiofur sodium in the treatment of foot disorders in dairy cows.

CASES

From February to April 2023, by evaluating a herd of 100 dairy cows (Holstein Friesian x Gyr) raised in a semi-extensive system in the region of Serra da Canastra, 4 cows were found to have foot disorders. The foot disorders were interdigital dermatitis ($n = 1$), sole hemorrhage and double sole ($n = 1$), and interdigital hyperplasia ($n = 2$). Treatment with regional perfusion with ceftiofur sodium was recommended for these animals.

After the affected limb was restrained and immobilized, the common dorsal digital vein was trichotomized, cleaned with 70% alcohol, and a rubber tourniquet was placed around the proximal metacarpal or metatarsal region. Then, venipuncture of the common dorsal digital vein was performed with a scalp vein infusion set (19G needle) to administer of

lidocaine hydrochloride without vasoconstrictor (2%) [Lidovet¹ - 20 mL/cow, i.v.] and ceftiofur sodium [Topcef^{®2} - 20 mL/cow, i.v., single dose of 1 g] for a total of 40 mL.

The tourniquet was kept on for 30 min to allow regional perfusion of the antibiotic. This period was used to surgically debride the lesions according to the lesion on the affected limb. After completing the procedure, debrided area was covered with 50 g of copper sulfate. Then, absorbent cotton, a dressing, bandage, and adhesive plaster were applied to the hoof (Figure 1). After 30 min, the tourniquet was removed and a combination of meloxicam and dipyrone was administered [Prador^{®3} - 20 mL/cow, i.m.] to induce analgesia.

LCS [6] and BCS [4] were assessed weekly in the treated cows, along with changing the dressing and cleaning the affected limb with running water and neutral soap. The LCS was elevated in the initial assessments (median = 2) but returned to normal by the end of treatment in 3 animals (median = 1), whereas the BCS remained relatively stable throughout the treatment period (median = 3). The cow diagnosed with sole ulcers and double sole showed an increase in LCS (median = 4) over the course of treatment due to the requirement of curettage. However, there was a decrease in LCS (median = 2) observed during the final week of treatment, without returning to the minimum LCS value, but with hoof healing (Figure 2).

The recovery period of the animals evaluated ranged from 4 to 7 weeks. Milk yield was estimated by 3 weighings in the farm at 2-month intervals. The 1st (average = 14.25 L), 2nd (average = 12.75 L), and 3rd (average = 10.5 L) weighings were performed before

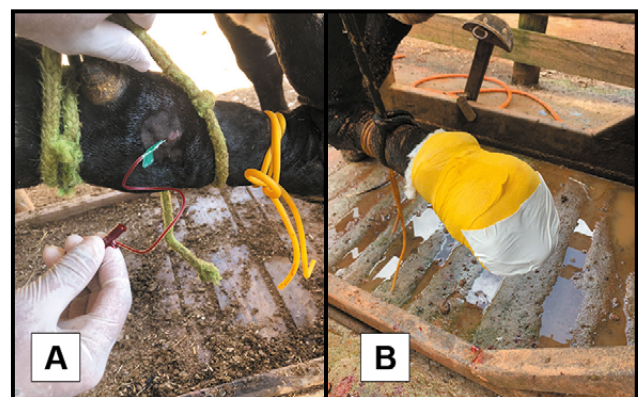


Figure 1. A- Cow limb with a tourniquet around the middle metacarpal region. Venipuncture of the common dorsal digital vein is performed using a needle. B- Cow hoof covered using a cotton dressing, bandage, and adhesive plaster.

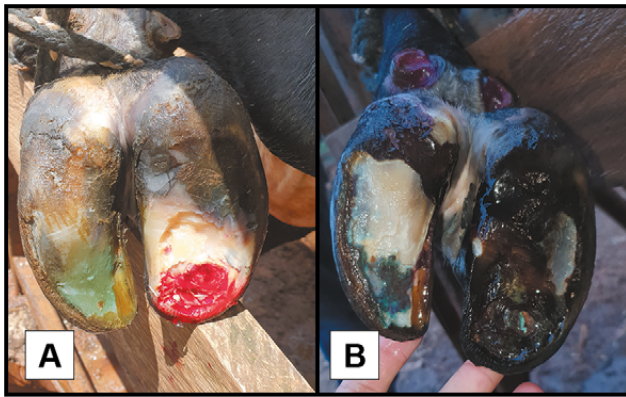


Figure 2. A- Cow hoof diagnosed with sole ulcer and double sole. B- Healed hoof after treatment.

the lesions appeared, at the start of treatment, and after the animals recovered, respectively.

The cost of regional perfusion with analgesia was BRL 63.10 per animal, which includes the cost of antibiotics, analgesics, and local anesthetics, as well as materials such as scalpels, syringes, and needles. The number of dressings varied from 4 to 7 per animal. Each dressing cost BRL 22.40 and consisted of gauze, absorbent cotton, a cotton strip, a bandage, and an adhesive plaster. Copper sulfate was used in the 1st dressing and cost BRL 5.00 per animal. Therefore, the average cost of the complete treatment was BRL 185.70 per animal, with values ranging from BRL 224.90 to BRL 157.70, depending on the number of dressings.

DISCUSSION

The use of ceftiofur sodium by the regional perfusion technique in the treatment of foot disorders is rarely described in the literature. We found a report of the successful recovery of a cow with interdigital necrobacillosis by curettage of the lesion associated with two regional infusions with ceftiofur sodium and dressings changed every 48 h, up to a total of 6 dressings. The animal received topical and footbath treatments for 6 months without healing; however, it displayed improvement after the 1st regional perfusion session [7]. Based on this report, we opted for just 1 session of regional perfusion with ceftiofur sodium due to the less severe nature of the foot disorders diagnosed in this study.

Another study demonstrated that cows with digital dermatitis showed a complete recovery of the lesions more quickly using regional perfusion with ceftiofur sodium when compared to topical

applications of oxytetracycline [10], showing the benefits of this technique compared to other treatments. The cows evaluated in this study confirmed the success of treatment using ceftiofur sodium by regional perfusion without the need for topical treatment with oxytetracycline.

The decline in milk production corresponds to the increase in LCS; therefore, effective treatment for LCS improvement leads to an increase in the average daily milk yield [11,13]. However, this study did not demonstrate this result, as the 3 milk yield weighings produced similar values. This may be due to a slight increase in LCS observed in the studied cows, associated with environmental factors such as excess humidity and hindered farm handling due to high rainfall.

The average cost of treatment per animal was BRL 185.70, but this did not include the cost of transportation and fees. In 2004, a survey examined the costs associated with treating foot disorders in cows raised in a free-stall system. The survey considered fees, transportation costs, and materials, and determined an average cost of USD 44.68, which converted to the present day is equivalent to BRL 219.80; however, these figures are outdated since they do not account for inflation during the period [5].

In 2008, another study was conducted to assess the effectiveness of systemic oxytetracycline in combination with oxytetracycline powder and footbaths in treating foot disorders, and the average cost of the treatment was found to be BRL 158.96 [12]. Despite the outdated figures being lower than those in our study, it is worth noting that the laboratories that manufacture injectable oxytetracycline do not recommend administering the product to dairy cows that produce milk for human consumption. This information highlights the importance of using antibiotics that leave no residue in the milk of cows, such as ceftiofur sodium.

In 2010, a study on 6 lactating cows found no residues in the milk 24 h after intramuscular administration of ceftiofur sodium at a dose of 1 or 2 mg/kg [3]. This dose of antimicrobial is similar to that used in regional perfusion (1 g), considering the average weight of 500 kg of the evaluated cows.

Finally, the use of ceftiofur sodium for foot disorder treatment eliminates the need to dispose of milk during the treatment. This not only reduces revenue losses due to the quantity produced, but also avoids handling difficulties such as changes to the milking

process and finding a proper location to dispose of the milk without harming the environment or feeding it to other animals.

Therefore, the use of regional perfusion with ceftiofur sodium showed favorable outcomes in treating foot disorders in dairy cows, eliminating the need to discard milk, and thus reducing losses for farmers.

MANUFACTURERS

¹Bravet, Laboratório Bravet Ltda. Rio de Janeiro, RJ, Brazil.

²Ipanema Indústria de Produtos Veterinários Ltda. Araçoiaba da Serra, SP, Brazil.

³J.A. Saúde animal. Patrocínio Paulista, SP, Brazil.

Declaration of interest. The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

REFERENCES

- 1 **Barbosa A., Pizoni C., Luz G.B., Correa N., Rabassa V.R., Del Pino F.A.B., Moraes F.P. & Martins C.F. 2018.** Relação entre escore de condição corporal e escore de locomoção em vacas leiteiras submetidas a manejo semiextensivo de alimentação. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*. 70(4): 1129-1134. DOI: 10.1590/1678-4162-9978.
- 2 **Borges J.R.J., Câmara A.C.L., Moscardini A R.C., Rodrigues C.A., Pitombo C.A., Graça F.A.S., Silva L.A.F., Silva P.C.A.R., Cunha P.H.J., Vianna R.B., Rabelo R.E. & Ollhof R.D. 2017.** Doenças dos dígitos dos bovinos: nomenclatura padronizada para o Brasil. *Revista do Conselho Federal de Medicina Veterinária*. 23(73): 45-52. ISSN: 1517-6959
- 3 **Cristina M., Melo R.T., Mendonça E.P., Coelho L.R. & Rossi D.A. 2010.** Uso de ceftiofur em vacas leiteiras e sua excreção no leite. *Pubvet*. 4(33): 931-937.
- 4 **Edmonson A.J., Lean I.J., Weaver L., Farver T. & Webster G. 1989.** A body condition scoring chart for holstein dairy cows. *Journal of Dairy Science*. 72(1): 68-78. DOI: 10.3168/jds.S0022-0302(89)79081-0
- 5 **Ferreira P.M., Leite R.C., Carvalho A.U., Facury Filho E.J., Souza R.C. & Ferreira M.G. 2004.** Custo e resultados do tratamento de seqüelas de laminites bovina: relato de 112 casos em vacas em lactação no sistema free-stall. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*. 56(5): 589-594. DOI: 10.1590/S0102-09352004000500004.
- 6 **Flower F.C. & Weary D.M. 2006.** Effect of Hoof Pathologies on Subjective Assessments of Dairy Cow Gait. *Journal of Dairy Science*. 89(1): 139-146. DOI: 10.3168/jds.S0022-0302(06)72077-X.
- 7 **Fonseca L.S., Ginelli A.M.G., Franco M.C., Silva T.J.F., Silva W.K.B.F., Leite J.S., Brito K.M.N., Ferreira Jr. J.V.T. & Mendes Jr. J.W. 2017.** Necrobacilose interdigital em bovino com tratamento por perfusão regional: relato de caso. *Revista Acadêmica Ciência Animal*. 15(Suppl 2): 551-552.
- 8 **Gomes J.P.F.S., Ramos R.R., Frias D.F.R., Marques V.B., Andreani D.I.K. & Fernandes A.U. 2016.** Evidências do efeito da terapia fotodinâmica sobre infecções podais em vacas leiteiras no município de Fernandópolis, São Paulo, Brasil. *Revista Brasileira de Medicina Veterinária*. 38(3): 257-264.
- 9 **Gorden P.L., Kleinhenz M.D., Wulf L.W., Rajewski S.J., Wang C., Gehring R. & Coetzee J.F. 2018.** Comparative plasma and interstitial fluid pharmacokinetics of flunixin meglumine and ceftiofur hydrochloride following individual and co-administration in dairy cows. *Veterinary Pharmacology and Therapeutics*. 41(1): 76-82. DOI: 10.1111/jvp.12437.
- 10 **Kamiloglu A., Demirkan I. & Baran V. 2002.** Comparison of Ceftiofur Sodium by Intravenous Regional Antibiotherapy and Local Oxytetracycline Application for Treatment of Bovine Digital Dermatitis. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*. 8(2): 107-110.
- 11 **Kibar M. & Çaglayan T. 2016.** Effect of hoof trimming on milk yield in dairy cows with foot disease. *Acta Scientiae Veterinariae*. 44(1): 1-7. DOI:10.22456/1679-9216.81077
- 12 **Leão M.A., Fioravanti A.C.S., Silva O.C., Serafim J., Moura M.I., Caetano L.B., Eurides D. & Silva L.A.F. 2008.** Dermatite digital bovina: resposta terapêutica e custo dos protocolos adotados em duas propriedades rurais. *Revista Brasileira de Ciência Veterinária*. 15(3): 111-116. DOI: 10.4322/rbcv.2014.210.
- 13 **Reader J.D., Green M.J., Kaler J., Mason S.A. & Green L.E. 2011.** Effect of mobility score on milk yield and activity in dairy cattle. *American Dairy Science Association*. 94(10): 5045-5052. DOI: 10.3168/jds.2011-4415.
- 14 **Schade J., Curti J.M., Gonçalves G.R., Silva T.P. & Appolonio E.V.P. 2019.** Perfusão regional do membro com antimicrobianos em equinos. *Revista de Ciências Agroveterinárias*. 18(2): 281-291. DOI: 10.5965/223811711812019281.

- 15 Serra R.M.C., Dias R.C., Cavalcante M.P. & Alzamora Filho F. 2017.** Prevalência das afecções podais e morfometria do casco de vacas lactantes na bacia leiteira de Ilhéus-Itabuna, Bahia. *Revista Investigação*. 16(1): 46-50. DOI: 10.26843/investigacao.v16i1.1730.
- 16 Tomasella T.E., Negri Filho L.C., Affonso M.Z., Barca Jr. F., Silva L.C. & Okano W. 2014.** Prevalência e classificações de lesões podais em bovinos leiteiros na região de Belo Horizonte - MG. *Revista Brasileira de Higiene e Sanidade Animal*. 8(1): 115-127. DOI: 10.5935/1981-2965.20140008.