





Success of nitenpyram in the treatment of ocular myiasis in the orbital cavity of a dog - case report

Sucesso do nitempiram no tratamento de miíase ocular em cavidade orbital em cão - relato de caso

Fernando Rocha Miranda¹ , Renan Bernardes Tavares² , Ciro Eugenio da Silva de Oliveira² , Emily Andressa Santos¹ , Diefrey Ribeiro Campos³ , Fabio Barbour Scott⁴  and Júlio Israel Fernandes⁵ 

¹Veterinary, Laboratório de Quimioterapia Experimental em Parasitologia Veterinária - LQEPV, Universidade Federal Rural do Rio de Janeiro - UFRRJ, Seropédica, RJ, Brasil

²Veterinary Medicine Graduate Student, Universidade Federal Rural do Rio de Janeiro - UFRRJ, Seropédica, RJ, Brasil

³Veterinary, Dr. Programa de Pós-graduação em Ciências Veterinárias - PPGMV, Universidade Federal Rural do Rio de Janeiro - UFRRJ, Seropédica, RJ, Brasil

⁴Veterinary, Dr. Departamento de Parasitologia Animal, Universidade Federal Rural do Rio de Janeiro - UFRRJ, Seropédica, RJ, Brasil

⁵Veterinary, Dr. Departamento de Medicina e Cirurgia Veterinária, Universidade Federal Rural do Rio de Janeiro - UFRRJ, Seropédica, RJ, Brasil

Abstract

The aim of this study is to report the efficacy of nitenpyram against *Cochiliomyia hominivorax* larvae in ocular myiasis of a naturally infested dog. A female Beagle with ocular myiasis was attended. After care and clinical examination, the involvement of the entire ocular and periocular region was found. The animal was treated orally with a dose of 4.7 mg/kg of nitenpyram together with analgesic medication. The expulsion and fall of live and dead larvae were evaluated by quantification every 15 minutes in the first hour and thereafter at 2, 3, 4, 6 and 18 hour intervals, followed by manual removal of the larvae. Overall effectiveness, larval expulsion rate and larvicidal effect of nitenpyram were determined. In all, there were 140 larvae in the lesion, of which 90 live and 46 dead larvae were expelled, while 4 dead larvae were mechanically removed, presenting 100% overall effectiveness, with larval expulsion activity of 97.1% and larvicidal efficacy of 35.7%. Based on the results obtained in this case, it can be concluded that nitenpyram has rapid and safe action against *C. hominivorax* larvae, making it a promising therapeutic alternative for the elimination of myiasis in the orbital cavity of dogs.

Keywords: ophthalmology, myiasis, parasitology, ocular globe.

Resumo

O objetivo deste estudo foi relatar a eficácia do nitempiram frente a larvas de *Cochiliomyia hominivorax* em miíase ocular em um cão naturalmente infestado. Foi atendido um cão, fêmea, adulto da raça Beagle que apresentava o quadro de miíase ocular. Após o atendimento e exame físico, foi constatado acometimento de toda a região ocular e periocular. O animal foi tratado com nitempiram, recebendo a dose de 4,7 mg/kg por via oral, juntamente com medicação analgésica. Foram avaliadas a expulsão e queda das larvas vivas e mortas, as quais foram quantificadas a cada 15 minutos na primeira hora e depois nos intervalos de 2, 3, 4, 6, 18 horas pós-tratamento e posterior remoção manual das larvas. Foram calculadas a eficácia global, a taxa de expulsão larval e o efeito larvicida do nitempiram. No total existiam na lesão 140 larvas das quais foram expelidas 90 larvas vivas, 46 larvas mortas e removidas mecanicamente 4 larvas mortas, apresentando uma eficácia global de 100%, com atividade de expulsão larval de 97,1% e eficácia larvicida de 35,7%. Com base nos resultados obtidos neste caso, é possível concluir que o nitempiram tem uma ação rápida e segura sob larvas de *C. hominivorax*, se mostrando uma boa alternativa terapêutica para a eliminação de miíases em cavidade orbital de cães.

Palavras-chave: oftalmologia, miíase, parasitologia, globo ocular.

Introduction

Myiasis is a disease characterized by infection by dipterous larvae, mainly occurring in tissues and cavities of humans and animals (Han et al., 2018a). Injuries from tick fixation, surgical procedures, fights, bites or perforation are the main lesions that attract flies to lay eggs, where



How to cite: Miranda F.R., Tavares R.B., Oliveira C.E.S., Santos E.A., Campos D.R., Scott F.B., Fernandes J.I. (2020). Success of nitenpyram in the treatment of ocular myiasis in the orbital cavity of a dog - case report. *Brazilian Journal of Veterinary Medicine*, 40: e108920. doi: 10.29374/2527-2179.bjvm108920.

Financial support: FAPUR, CNPq.

Conflict of interests: No conflict of interests declared concerning the publication of this article.


Received: October 09, 2019.

Accepted: January 23, 2020

The study was carried out at Laboratório de Quimioterapia Experimental em Parasitologia Veterinária - LQEPV Animal Parasitology Departamento de Parasitologia Animal - DPA-ADP, Universidade Federal Rural do Rio de Janeiro - UFRRJ.

*Correspondence:

Fernando Rocha Miranda
Rua Vereador Aldacir Medeiros, 140
CEP 23894-438 - Seropédica (RJ), Brasil
E-mail: fernando_miranda02@hotmail.com

 Copyright Miranda et al. This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License which permits unrestricted non-commercial use, distribution, and reproduction in any medium provided the original work is properly cited.

the eclosion of larvae causes myiasis. Those can penetrate into the injuries, liberating proteolytic enzymes that can digest tissues, consequently causing extensive wounds (Singh et al., 2017).

Cochliomyia hominivorax is the main myiasis causing species, known as the new world screw-worm fly. The diagnosis is primarily based in the presence of larvae (maggots) in the wound (Han et al., 2018b)

After the eggs hatch in the primary lesion, the larvae perforate the tissue, causing myiasis. Depending on the location, dimension and severity of the injury, it can cause disfiguring lesions, claudication, tooth injuries, peritonitis and other clinical manifestations, leading to anorexia and weight loss. (Choe et al., 2016).

In severe cases, the infested animals can be killed by toxemia, hemorrhagic processes and/or secondary bacterial infection, leading to clinical cases of sepsis (Choe et al., 2016). In cases of ocular myiasis, the invasive larvae are able to cause destruction of the orbital tissue, leading to blindness, ocular globe damage and death (Sharun & Manjusha, 2019).

The main therapeutic measures in myiasis cases are cleaning, trichotomy of the lesion's peripheral region, debridement of the infected areas following the removal of the larvae, associated with the use of antibiotics, analgesics and repellents (Sunny et al., 2016).

Some drugs can be used as auxiliary treatment, eliminating the living larvae or causing their death at the site (Han et al. 2018a).

The use of drugs belonging to the isoxazoline group, such as afoxolaner, has been reported for the treatment of myiasis caused by *Chrysomya bezziana*. However, despite its effectiveness, it does not act as quickly as neonicotinoids (Han et al., 2018b). Spinosad is another drug that has been used, with 80% efficacy in myiasis control, but it also acts slowly (Oliveira et al., 2018)

Nitenpyram is a drug belonging to the neonicotinoids group; It acts in the central neural system of insects, causing post-synaptic blockage in the nicotinic acetylcholine receptors, with 100% efficacy against fleas (Buszewski et al., 2019). Nitenpyram is recommended for fast treatment of flea infestation in dogs and cats, and its initial effect starts in 15 to 30 minutes. It can also be used for treatment of myiasis caused by larvae of *C. hominivorax* (Han et al., 2018b). There are few articles about the activity of nitenpyram, and none about myiasis in the ocular bulb caused by *C. hominivorax* larvae.

Here we report the treatment with nitenpyram of a naturally infested dog suffering from extensive myiasis of the ocular bulb caused by *C. hominivorax* larvae.

Clinical case

An eight-year-old female Beagle, weighing 14 kg, was attended in the city of Seropédica, in the state of Rio de Janeiro, Brazil. The dog was naturally infested by *C. hominivorax* larvae. The lesions were caused by the larvae in the left eye, mainly in the ocular bulb and a large part of the orbital cavity (Picture 1). The dog had docile mood while prostrate, permitting detection of the ocular myiasis by visual observation and characteristic odor of the lesion caused by the larvae. The animal was medicated orally with nitenpyram (Capstar®, Elanco Animal Health) at a dose of 1mg/kg.

As analgesic therapy, 25 mg/kg of dipyrone was given orally each eight hours, along with 0.1 mg/kg of meloxicam orally each 24 hours, and 4 mg/kg of tramadol chlorhydrate intramuscularly each 12 hours.

During the evaluations to count the larvae, the animal was kept in an individual cage (70cm x 70cm x 70cm) with white bottom and removable tray, sealed with Vaseline to keep the larvae out of the tray after collection. Observations were performed each 15 minutes in the first hour and then at intervals of two, three, four, six and eighteen hours post treatment, according to the method described by Correia et al. (2010).

To measure the efficacy, three criteria were used: larval expulsion rate (LER), calculated by the formula $[(\text{number of dead expelled larvae} + \text{number of living expelled larvae}) / (\text{total larvae}) \times 100]$; larvicidal action rate (LAR), by the formula $[(\text{number of dead expelled larvae} + \text{number of dead removed larvae}) / (\text{total larvae}) \times 100]$; and global efficacy, by the formula $[(\text{number of dead expelled larvae} + \text{number of living expelled larvae} + \text{number of living removed larvae}) / (\text{total larvae}) \times 100]$. The results are displayed in Table 1.



Picture 1. Extensive myiasis in left eye bulb region by *Cochliomyia hominivorax* larvae. Note the high degree of parasitism with larvae stage L1 on the medial eyelid commissure and L2 and L3 as it moves toward the lateral eyelid commissure.

Table 1. Efficacy of nitenpyram (Capstar®) against *Cochliomyia hominivorax* larvae in ocular myiasis of a naturally infested dog.

Período pós tratamento	Número de larvas expelidas
15'	0
30'	5
45'	8
1h	7
2h	22
3h	59
4h	15
5h	12
6h	1
18h	7
24h	4
Expelled larvae	90
Removed larvae	4
Total larvae	140
Expulsion rate (%)	97.1
Larvicidal efficacy (%)	35.7
Global efficacy (%)	100

After 24 hours, 140 dead and living larvae were found. Of those, 90 larvae were expelled alive 30 minutes after treatment for five hours.

The larvae were classified as *C. hominivorax* using a magnifying glass according to Guimarães & Papavero (2009).

A day after the beginning of treatment, the dog was examined for physiological parameters, including cardiac and respiratory frequency and rectal temperature. The results indicated its general state was clinically stable. The whole treatment was continued until the total elimination of the larvae.

Nitenpyram had global efficacy of 100%, meaning it is an efficacious drug with good results regarding larval expulsion. At the end of the treatment, the local of lesion was completely free of infection, as can be seeing Picture 2, and the animal did not show any discomfort.

After 24 hours, four remaining larvae were mechanically removed from the injury using tweezers. For this procedure, the animal was sedated, using 0.05 mg/kg of acepromazine associated with 4 mg/kg of meperidine. Then the lesion was cleaned with antiseptic solution and the dog was treated with healing eye drops and antibiotic and analgesic therapy.



Picture2. Eye bulb region after 24 hours of nitenpyram treatment.

Discussion

Nitenpyram is rapidly absorbed by the gastrointestinal tract, so it has fast action, as indicated by the hyperexcitation observed in the larvae after 15 minutes of treatment, and the increase of head wiggling by the dog, probably due to the discomfort caused by the movement of the excited parasites in the orbital cavity, 30 minutes after the drug administration.

The plasmatic concentration peaks are achieved between 15 minutes and 1 hour post administration, allowing rapid and efficient response. In addition, there is profuse blood distribution to the periocular tissues, because according to Hillock et al. (2006), Canidae have quick reestablishment of blood supply to damaged areas in the head region.

Another hypothesis that must be considered is the lacrimal pharmacological secretion and possible elimination of neonicotinoids thereby, which can partly explain the treatment's success and fast action. Even though renal excretion is the main form of metabolic excretion of substances, other minor elimination routes exist, such as via milk, saliva, sweat and tears must be taken into consideration (Baumann et al., 2019).

The larval expulsion rate was 97.1%, showing one of the main reasons why nitenpyram can be used as alternative therapy, facilitating the clinical work. It compares favorably with other drugs commonly used for myiasis control, such as macrocyclic lactones, which besides having lower efficacy than nitenpyram, also cause intensive pain when administered subcutaneously, or pyrethroid insecticides, which have a higher expulsion rate (Hribar et al., 2018), but kill the parasites in the lesion, demanding greater care to completely remove all larvae.

A high larval expulsion rate was also observed due to the head wiggling by the animal. This fact can be explained by the drug's action, which initially causes hyperexcitation of the parasites, in turn causing severe discomfort in the dog, provoking abrupt head movements that mechanically expel the exposed larvae.

After 24 hours' treatment, 140 dead larvae were counted, but the larvicidal activity of the nitenpyram was only 37.5%. Most of the living larvae were unattached, probably because the drug causes primary paralysis and subsequent death outside the infested site.

Death by paralysis can be related to the main route of action of the neonicotinoids, which act blocking the nicotinic receptors at the motor plate, causing flaccid paralysis by preventing depolarized action (Buszewski et al., 2019).

Nitenpyram when compared to other antiparasitics, such as afoxolaner, spinosyns, and milbemycin, presents higher efficacy regarding the start of pharmacological activity and time to kill larvae of the genus *Chrysomya*, a fact that can be observed in the treatment of myiasis caused by *C. hominivorax* (Han et al., 2018b).

The use of anti-inflammatory and antibiotic drugs was also necessary, to protect the lesion from infection and prevent new posture areas.

Conclusion

The oral treatment with nitenpyram was effective to eliminate the larvae of *C. hominivorax* in ocular myiasis in a naturally infested dog, proving to be a therapeutic alternative due to its efficacy and fast action.

References

- Baumann, A., Piel, I., Hucke, F., Sandmann, S., Hetzel, T., & Schwarz, T. (2019). Pharmacokinetics, excretion, distribution, and metabolism of 60-kDa polyethylene glycol used in BAY 94-9027 in rats and its value for human prediction. *European Journal of Pharmaceutical Sciences*, 130, 11-20. <http://dx.doi.org/10.1016/j.ejps.2019.01.015>. PMID:30654111.
- Buszewski, B., Bukowska, M., Ligor, M., & Staneczko-Baranowska, I. (2019). A holistic study of neonicotinoids neuroactive insecticides-properties, applications, occurrence, and analysis. *Environmental Science and Pollution Research International*, 26(34), 1-18. <http://dx.doi.org/10.1007/s11356-019-06114-w>. PMID:31520389.
- Choe, S., Lee, D., Park, H., Jeon, H. K., Kim, H., Kang, J. H., Jee, C. H., & Eom, K. S. (2016). Canine wound myiasis caused by *Lucilia sericata* (Diptera: Calliphoridae) in Korea. *Korean Journal of Parasitology*, 54(5), 667-671. <http://dx.doi.org/10.3347/kjp.2016.54.5.667>. PMID:27853125.

- Correia, T. R., Scott, F. B., Verocai, G. G., Souza, C. P., Fernandes, J. I., Melo, R. P. S., Vieira, V. P. C., & Ribeiro, F. A. (2010). Larvicidal efficacy of nitenpyram on the treatment of myiasis caused by *Cochliomyia hominivorax* (Diptera: Calliphoridae) in dogs. *Veterinary Parasitology*, 173(1-2), 169-172. <http://dx.doi.org/10.1016/j.vetpar.2010.06.019>. PMID:20638181.
- Guimarães, J. H., & Papavero, N. (2009). *Myiasis in man and animals in the neotropical region: Bibliographic Database*. São Paulo: FAPESP: Plêiade.
- Han, H. S., Chen, C., Schievano, C., & Noli, C. (2018a) The comparative efficacy of afoxolaner, spinosad, milbemycin, spinosad plus milbemycin, and nitenpyram for the treatment of canine cutaneous myiasis. *Veterinary Dermatology*, 29: 312-e109.
- Han, H. S., Toh, P. Y., Yoong, H. B., Loh, H. M., Tan, L. L., & Ng, Y. Y. (2018b). Canine and feline cutaneous screw worm myiasis in Malaysia: clinical aspects in 76 cases. *Veterinary Dermatology*, 29(5), 442-e148. <http://dx.doi.org/10.1111/vde.12672>. PMID:30066413.
- Hillock, S. M., Dewey, C. W., Stefanacci, J. D., & Fondacaro, J. V. (2006). Vascular encephalopathies in dogs: incidence, risk factors, pathophysiology, and clinical signs. *Compendium on continuing education for the practicing veterinarian*. 28(3):196-207.
- Hribar, L. J., Murray, H. L., McIntire, S. G., & Pruszynski, C. A. (2018). Effects of mosquito control adulticides on Sterile *Cochliomyia hominivorax* (Diptera: Calliphoridae). *Journal of Economic Entomology*, 111(2), 959-966. <http://dx.doi.org/10.1093/jee/tox352>. PMID:29365134.
- Oliveira, P. C., Moraes, P. A., Scott, F. B., Verocai, G. G., Correia, T. R., & Fernandes, J. I. (2018). Efficacy of spinosad on the treatment of myiasis caused by *Cochliomyia hominivorax* (Diptera: Calliphoridae) in dogs. *Veterinary Parasitology*, 258, 53-56. <http://dx.doi.org/10.1016/j.vetpar.2018.06.006>. PMID:30105978.
- Sharun, K., & Manjusha, K. M. (2019). Medical Management of Orbital Myiasis using 0.1% w/v Topical Ivermectin Preparation in a Calf. *International Journal of Current Microbiology and Applied Sciences*, 8(5), 1796-1800. <http://dx.doi.org/10.20546/ijcmas.2019.805.208>.
- Singh, K., Kumar, S., Yadav, I., & Sangwan, A. (2017). Management of Maggot Wound (Myiasis) in Dog Ear. *Veterinary Clinical Science*, 5(1), 6-8. http://jakraya.com/journal/pdf/14-vcsArticle_2.pdf
- Sunny, B., Sulthana, L., James, A., & Sivakumar, T. (2016). Maggot infestation: Various treatment modalities. *the journal of the american college of clinical wound specialists*, 8(1-3), 51-53. <http://dx.doi.org/10.1016/j.jccw.2018.03.002>. PMID:30276127.