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CANINE EHRLICHIOSIS: INTEGRATIVE REVIEW OF CASE STUDIES ON TREATMENTS BETWEEN 2020 AND 2024

ERLIQUIOSE CANINA: REVISÃO INTEGRATIVA DE ESTUDOS DE CASO SOBRE TRATAMENTOS ENTRE 2020 E 2024

EHRLICHIOSIS CANINA: REVISIÓN INTEGRAL DE ESTUDIOS DE CASO SOBRE TRATAMIENTOS ENTRE 2020 Y 2024

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ABSTRACT

Canine ehrlichiosis, caused by the bacterium Ehrlichia canis and transmitted by the tick Rhipicephalus sanguineus, is a severe systemic disease. This study conducted an integrative review of clinical cases published between 2020 and 2024, focusing on the therapeutic protocols used and the patients' responses. Doxycycline was the most frequently used antibiotic, with variations in dosage and the need for additional clinical support. Treatment effectiveness is associated with early diagnosis, appropriate clinical management, and the continuous use of preventive measures. Despite recent advances, challenges remain in standardizing care and raising awareness among pet owners, highlighting the need for educational initiatives and public veterinary policies.

Keywords: Canine Ehrlichiosis. *Ehrlichia canis*. Tick *Rhipicephalus sanguineus*. Doxycycline. Treatment. Veterinary Medicine.

RESUMO

A erliquiose canina, causada pela bactéria Ehrlichia canis e transmitida pelo carrapato Rhipicephalus sanguineus, é uma doença sistêmica de alta gravidade. Este estudo realizou uma revisão integrativa de casos clínicos publicados entre 2020 e 2024, com foco nos protocolos terapêuticos utilizados e na resposta dos pacientes. A Doxiciclina foi o antibiótico mais recorrente, com variações nas doses e na necessidade de suporte clínico adicional. A eficácia do tratamento está associada ao diagnóstico precoce, à condução clínica adequada e ao uso contínuo de medidas preventivas. Apesar dos avanços, persistem desafios na padronização dos cuidados e na conscientização dos tutores, exigindo ações educativas e políticas públicas veterinárias.

Palavras-chave: Erliquiose Canina. *Ehrlichia canis*. Carrapato *Rhipicephalus sanguineus*. Doxiciclina. Tratamento. Medicina Veterinária.

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RESUMEN

La ehrlichiosis canina, causada por la bacteria Ehrlichia canis y transmitida por la garrapata Rhipicephalus sanguineus, es una enfermedad sistémica muy grave. Este estudio realizó una revisión integrativa de casos clínicos publicados entre 2020 y 2024, centrándose en los protocolos terapéuticos utilizados y las respuestas de los pacientes. La doxiciclina fue el antibiótico más utilizado, con variaciones en la dosis y la necesidad de apoyo clínico adicional. La eficacia del tratamiento se asocia con el diagnóstico temprano, el manejo clínico adecuado y el uso continuo de medidas preventivas. A pesar de los avances, persisten los desafíos para estandarizar la atención y concienciar a los dueños de mascotas, lo que requiere iniciativas educativas y políticas públicas veterinarias.

Palabras clave: Ehrlichiosis Canina. *Ehrlichia canis*. Garrapata *Rhipicephalus sanguineus*. Doxiciclina. Tratamiento. Medicina Veterinaria.

1 INTRODUCTION

Canine ehrlichiosis is caused by the bacterium *Ehrlichia canis* (EC), a hemoparasite belonging to the order *Rickettsiales*. The bacterium is gram-negative, cocobacillary, pleomorphic and obligatorily intracellular, belonging to the *Anaplasmataceae* family. This species is the etiological agent of canine monocytic ehrlichiosis, an infectious disease transmitted mainly by ticks of the genus *Rhipicephalus*, especially *Rhipicephalus sanguineus*. The bacterium has a tropism for cells of the phagocytic mononuclear system, such as monocytes and macrophages, in which it multiplies forming structures called morulae — bacterial clusters visible in the cytoplasm of infected cells in cytological tests (Silva, 2015; Caetano; Coast; Junior, 2023).

Morphologically, EC has dimensions ranging from 0.2 to 1.5 micrometers and does not have a typical cell wall, which makes it difficult to stain by conventional methods such as Gram staining. Therefore, techniques such as Giemsa or Diff-Quick are preferred for the visualization of morulae in blood smears. Replication occurs within cytoplasmic vacuoles, where the bacterium protects itself from the host's immune response. This characteristic of intracellular parasitism is common among members of the order *Rickettsiales*, to which the pathogen belongs (Silva, 2015; UFRJ, 2026; Caetano; Coast; Junior, 2023).

From a taxonomic point of view, EC is classified in the domain Bacteria, phylum Pseudomonadota (formerly known as Proteobacteria), class *Alphaproteobacteria*, order *Rickettsiales*, family *Anaplasmataceae* and genus *Ehrlichia*. The species was first described by Donatien and Lestoquard in 1935, and its classification was later revised by Dumler et al. (2001), who reorganized the genera of the order Rickettsiales based on phylogenetic analyses of ribosomal RNA sequences and conserved genes. This reorganization consolidated *E. canis* as a distinct species within the genus *Ehrlichia*, differentiating it from other species such as *Ehrlichia chaffeensis* and *Ehrlichia ewingii*, which also infect mammals but have different cellular tropisms and epidemiologies.

Understanding the morphology and taxonomic classification of *Ehrlichia canis* is critical for the diagnosis, treatment, and control of canine ehrlichiosis, especially in tropical and subtropical regions where the vector is endemic. The continuous study of this bacterium contributes to the development of more accurate diagnostic methods and effective therapeutic strategies, in addition to reinforcing the importance of preventive veterinary medicine. The disease is endemic in tropical and subtropical regions, such as Brazil, due to the high prevalence of the vector *Rhipicephalus sanguineus*. The incidence has increased in recent years, becoming a growing concern in veterinary medicine (Marques; Gomes, 2020).

The main vector is the dog's brown tick, *Rhipicephalus sanguineus*, which transmits the bacteria during the blood meal through saliva. Transmission can also occur, although rarely, by blood transfusion (Caetano; Coast; Junior, 2023).

Rhipicephalus sanguineus, popularly known as the brown dog tick, is a hematophagous ectoparasite belonging to the family *Ixodidae*, order *Acari*, class *Arachnida*. It is a species widely distributed in tropical and subtropical regions, with a high affinity for urban and domestic environments, being the main vector of agents such as *Ehrlichia canis*, *Babesia spp*. and *Anaplasma platys* (Caetano; Coast; Junior, 2023; Dantas-Torres; Sousa-Paula; Otranto, 2024)

Morphologically, adults have an oval body, dorsoventrally flattened, with a brown color that can vary from light to dark tones. The dorsal shield (idiosome) is rigid and covers the entire back in males, while in females it covers only the anterior region. They have four pairs of legs, anterior gnatossome with mouthparts adapted to piercing and suction, and absent eyes. In ventral view, the comma-shaped perithematic plates, a pair of well-developed anal plates, and the presence of garlands in males stand out. The species presents evident sexual dimorphism and intraspecific morphological variations that make accurate diagnosis difficult, requiring the use of refined taxonomic criteria. (Nogueira, et. al., 2020; Dantas-Torres; Sousa-Paula; Otranto, 2024).

Taxonomically, *Rhipicephalus sanguineus* belongs to the domain *Eukaryota*, kingdom *Animalia*, phylum *Arthropoda*, class *Arachnida*, order Ixodida, family *Ixodidae* and genus *Rhipicephalus*. The species was originally described as *Ixodes sanguineus* by Latreille in 1806, and was later reclassified by Koch in 1844 as *Rhipicephalus sanguineus*. Recent studies indicate that the so-called "*Rhipicephalus sanguineus* complex" encompasses several morphologically similar but genetically distinct lineages, such as *R. turanicus*, *R. linnaei* and *R. afranicus*, which makes its biosystematics still controversial (Nogueira, et. al., 2020; Dantas-Torres; Sousa-Paula; Otranto, 2024).

The intraspecific morphological diversity observed in populations from different geographic regions, such as Europe, America, and Africa, suggests that the *R. sanguineus* group may represent a set of cryptic species. This variability has direct implications for the epidemiology of tick-borne diseases, since different lineages may have different vector competencies.

Therefore, in-depth knowledge of the morphology and taxonomic classification of *Rhipicephalus sanguineus* is essential for the diagnosis, control and prevention of the diseases that this vector transmits, especially in urban environments with high density of dogs and low parasite control coverage.

After inoculation, *E. canis* multiplies in monocytes and spreads through the lymphatic and circulatory systems. This leads to vasculitis, destruction of platelets and red blood cells, and dysfunction of organs such as the spleen, liver, and bone marrow. The disease evolves in three phases: acute (fever, lethargy, anorexia), subclinical (without evident symptoms) and chronic (immunosuppression, anemia, thrombocytopenia and risk of death (Caetano; Coast; Junior, 2023).

Clinical diagnosis is challenging due to the nonspecificity of clinical signs. Tests such as blood count (thrombocytopenia is common), rapid tests (dot-ELISA, 4DX), PCR (more accurate for confirmation), serology, and complementary tests help the clinician in defining the diagnosis (Armando, 2022).

Treatment is based on antibiotic therapy, with Doxycycline being the drug of choice. In severe cases, supportive care such as fluid therapy, transfusions, and immunomodulators are required. The response to treatment depends on the stage of the disease and the clinical condition of the animal (Caetano; Coast; Junior, 2023).

There is no vaccine available. Prevention depends on strict vector control. The use of acaricide collars, application of spot-on or pour-on products and environmental cleaning are important prophylactic measures that should be implemented (Caetano; Coast; Junior, 2023). The high prevalence in tropical regions and the inadequate management of animals justify the relevance of the theme. The objective of this study was to conduct an integrative review of case studies published between 2020 and 2024, analyzing the treatments used, patient response, and possible complications.

2 METHODOLOGY

An integrative review was carried out based on scientific articles, case reports, and reviews published between 2020 and 2024, available in databases such as SciELO, PubVet, and CAPES. Studies with detailed therapeutic protocols were included, and those that did not address treatment were excluded. Ten studies were selected and critically analyzed, focusing on drug efficacy, clinical outcome, and preventive strategies.

After identifying and selecting the articles, a careful analysis of the protocols used was carried out, addressing issues such as efficacy, limitations, and perspectives. The data were organized and compared in a critical manner, highlighting best practices and gaps that still exist in the current literature.

3 RESULTS AND DISCUSSION

Ten studies published between 2020 and 2024 were analyzed, focusing on the treatments of canine ehrlichiosis in clinical cases. The selected studies presented therapeutic protocols, patient evolution and laboratory results.

3.1 ANALYSIS OF ARTICLES

To deepen the understanding of the therapeutic approaches to canine ehrlichiosis, an analytical framework was developed (CHART 1) based on ten references published between 2020 and 2024, selected for dealing directly with the topic. The studies include case reports, literature reviews, academic papers, and technical articles, allowing a broad and up-to-date view of the protocols used, their limitations, and recent advances. The analysis includes the type of study, the medications used, the clinical response observed and the authors' recommendations, contributing to the systematization of knowledge and to the construction of more effective conducts in veterinary practice.

Table 1

Treatment of Canine Ehrlichiosis (2020 – 2024)

ID	Title	Job Type	Authors	Local	Methodology
1	Therapeutic protocols in the treatment of canine monocytic ehrlichiosis.	Article	Azevedo, F. D.	RJ, Brazil	Evaluation of bacterial resistance and efficacy of alternative protocols.
2	Canine ehrlichiosis: literature review.	Revision	Armando, C.	SP. Brazil	Confirms Doxycycline as the antibiotic of choice.
3	Coinfection with Ehrlichia sp. and Anaplasma platys in domestic canine	Case report	Ferraz *et al*.	Brazil	Clinical description of a case of co-infection with laboratory analysis
4	Ehrlichiosis harms long-term health and requires attention.	Article	Poblete, S.	Brazil	It emphasizes post-treatment sequelae.
5	Relapsing canine monocytic ehrlichiosis: case report	Case report	Padilha *et al*.	Brazil	Description of a relapsed clinical case with laboratory tests
6	Canine ehrlichiosis: case report.	Article	Santos, L. S.	Sergipe Brazil	Case report
7	Clinical evaluation of	Dissertation	Silva, J. R.	Paraná	Evaluation of hematological

	dogs treated with Doxycycline for ehrlichiosis.			Brazil	response to treatment.
8	Canine monocytotropic ehrlichiosis: Review	Revision	Stival *et al*.	Brazil	Literature review of treatments and diagnosis
9	Use of integrative therapies in the treatment of canine ehrlichiosis.	TCC	Moura, T. A.	Minas Gerais, Brazil	Experimental study
10	Therapeutic protocols used in canine monocytic ehrlichiosis	Article	Rezende, M. Da S.	Bahia, Brazil	Evaluates protocols with Doxycycline and complementary therapies

Source: Data from the articles (2020-2024) compiled by the authors (2025).

AZEVEDO (2021), carried out the evaluation of bacterial resistance and efficacy of alternative protocols. The author proposes the use of antibiotics in association and concludes that Doxycycline is still effective, but there is a risk of resistance.

ARMANDO (2022), confirms Doxycycline as the antibiotic of choice and reinforces the importance of vector control. According to the author , treatment is effective, but prevention is essential.

In a case report, FERRAZ, et. al. (2021) studied a co-infection with *Ehrlichia canis* and *Anaplasma platys* in a domestic dog. According to the authors, the complex infection was treated with Doxycycline and imidocarb, demonstrating that the treatment was effective, but requires clinical surveillance.

POBLETE (2023), demonstrated that ehrlichiosis harms long-term health and requires attention. The author emphasizes that post-treatment sequelae may occur, suggesting prolonged clinical follow-up with immune and nutritional support.

PADILHA, et al. (2020), in a case report, studied relapsing canine monocytic ehrlichiosis. According to the authors, recurrence occurred after standard treatment of ehrlichiosis. Suggesting therapeutic failure or reinfection, reinforcing the importance of post-treatment examinations and environmental control.

SANTOS (2020), reports a case of ehrlichiosis treated with Doxycycline and clinical support. According to the author, complete clinical recovery occurs, confirming the effectiveness of the standard protocol.

SILVA (2023), carried out the clinical evaluation of dogs treated with Doxycycline for ehrlichiosis. This study was conducted with evaluation of the hematological response of the animals to the treatment. According to the author, the study showed positive results in 87% of cases, indicating that Doxycycline is effective, but requires follow-up tests.

STIVAL, et al. (2021), compare treatment protocols with Doxycycline, rifampicin, and clinical support. The authors point out limitations of clinical studies in the field and conclude that doxycycline remains the gold standard, but new therapeutic approaches are promising.

MOURA (2024), analyzed the use of integrative therapies in the treatment of canine ehrlichiosis. The author tested herbal medicines as a support to conventional treatment, obtaining promising results in immune recovery, suggesting that integrative therapies can complement the standard protocol.

REZENDE (2020), evaluated therapeutic protocols used in canine monocytic ehrlichiosis. In this literature review, the author evaluates protocols with doxycycline and complementary therapies. The study highlights antimicrobial resistance and the need for early diagnosis, suggesting that Doxycycline is effective but requires ongoing clinical monitoring.

The analysis of the selected studies shows that Doxycycline remains the antibiotic of choice in the treatment of canine ehrlichiosis, demonstrating significant efficacy in most clinical cases. However, reports of recurrence, coinfection, and bacterial resistance indicate the need for more individualized therapeutic protocols and continuous clinical monitoring. Recent literature also points to the complementary role of integrative therapies and immune support, especially in chronic cases or with hematological sequelae. In addition to medication conduct, environmental control and education of tutors are fundamental elements for the prevention of the disease and the reduction of reinfections. Thus, the body of evidence reinforces the importance of a multidisciplinary approach, which combines early diagnosis, effective treatment, and sustainable preventive strategies.

4 FINAL CONSIDERATIONS

This integrative review offers a comprehensive overview of the treatments used for CE, based on case studies published between 2020 and 2024. It was observed that, although Doxycycline remains the most used antibiotic, therapeutic protocols vary in terms of dosage, duration and need for complementary treatments, according to the clinical phase of the disease and the general condition of the animal. In addition, the effective management of the disease depends on an early diagnosis, the correct administration of medications, and continuous monitoring of the patient.

The research analyzed highlights the importance of environmental control and the use of antiparasitics as essential preventive strategies, especially in hot and humid regions, where the presence of the tick vector is more frequent. Despite advances in the clinical and therapeutic understanding of infection, there are still gaps in the standardization of treatment

protocols and prevention, reinforcing the need for further clinical and experimental studies in this area.

It is concluded, therefore, that the fight against CE requires not only the implementation of effective therapies, but also the promotion of educational actions aimed at tutors and the adoption of veterinary public health measures, aiming to reduce the incidence of the disease. This study systematizes the available knowledge and offers valuable subsidies for veterinary clinical practice, highlighting the relevance of a multidisciplinary approach in the control of vector-borne diseases.

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