




## THERAPEUTIC APPROACH AND CLINICAL MANAGEMENT PROTOCOLS IN THE TREATMENT OF CANINE EHRLICHIOSIS

### ABORDAGEM TERAPÊUTICA E PROTOCOLOS DE MANEJO CLÍNICO NO TRATAMENTO DA ERLIQUIOSE CANINA

### ABORDAJE TERAPÉUTICO Y PROTOCOLOS DE MANEJO CLÍNICO EN EL TRATAMIENTO DE LA EHRLICHIOSIS CANINA

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#### ABSTRACT

Canine monocytic ehrlichiosis (CME), caused by the bacterium *Ehrlichia canis* and transmitted by the tick *Rhipicephalus sanguineus*, is an important globally distributed zoonosis that can progress from acute presentations to severe chronic states characterized by progressive pancytopenia and bone marrow suppression. The therapeutic management of CME requires an integrated approach, focused both on the eradication of the etiological agent and on support for systemic damage, such as renal injury and vasculitis of the central nervous system. This study is a narrative literature review aimed at synthesizing recent scientific evidence on treatment protocols for CME. The literature reaffirms doxycycline as the standard protocol and drug of choice, demonstrating high efficacy in resolving complex clinical signs, including multifocal neurological lesions. In addition to antibiotic therapy, clinical management includes the promising use of adjuvant therapies, such as N-acetylcysteine (NAC), which acts as an antioxidant agent to enhance bone marrow activity and assist in the recovery of pancytopenia. Rigorous monitoring of target organs, using biomarkers such as SDMA and UP/C, is crucial for the early detection of alterations and prevention of progression to chronic kidney disease. It is concluded that successful treatment of canine ehrlichiosis depends on an integrated approach, based on the combination of doxycycline, preventive clinical monitoring, and targeted supportive interventions.

**Keywords:** Canine Ehrlichiosis. Doxycycline. Pancytopenia. N-acetylcysteine. Clinical Management.

#### RESUMO

A erliquiose monocítica canina (EMC), causada pela bactéria *Ehrlichia canis* e transmitida pelo carrapato *Rhipicephalus sanguineus*, é uma importante zoonose de distribuição global que pode progredir de quadros agudos para estados crônicos severos caracterizados por pancitopenia progressiva e supressão medular. O manejo terapêutico da EMC exige uma abordagem integrada, focada tanto na erradicação do agente etiológico quanto no suporte para os danos sistêmicos, como a injúria renal e as

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vasculites do sistema nervoso central. O presente estudo é uma revisão bibliográfica narrativa com o objetivo de sintetizar as evidências científicas recentes sobre os protocolos de tratamento da EMC. A literatura reafirma a doxiciclina como o protocolo padrão e fármaco de escolha, demonstrando alta eficácia na resolução de sinais clínicos complexos, inclusive lesões neurológicas multifocais. Além da antibioticoterapia, o manejo clínico inclui o uso promissor de terapias adjuvantes, como a N-acetilcisteína (NAC), que atua como agente antioxidante para potencializar a atividade da medula óssea e auxiliar na recuperação da pancitopenia. O monitoramento rigoroso de órgãos-alvo, utilizando biomarcadores como SDMA e UP/C, é crucial para a detecção precoce de alterações e prevenção da progressão para a doença renal crônica. Conclui-se que o sucesso no tratamento da erliquiose canina depende de uma abordagem integrada, baseada na associação entre doxiciclina, monitoramento clínico preventivo e intervenções de suporte direcionadas.

**Palavras-chave:** Erliquiose Canina. Doxiciclina. Pancitopenia. N-acetilcisteína. Manejo Clínico.

## RESUMEN

La ehrlichiosis monocítica canina (EMC), causada por la bacteria *Ehrlichia canis* y transmitida por la garrapata *Rhipicephalus sanguineus*, es una importante zoonosis de distribución global que puede progresar de cuadros agudos a estados crónicos severos caracterizados por pancitopenia progresiva y supresión medular. El manejo terapéutico de la EMC requiere un enfoque integrado, centrado tanto en la erradicación del agente etiológico como en el soporte de los daños sistémicos, como la lesión renal y las vasculitis del sistema nervioso central. El presente estudio es una revisión bibliográfica narrativa con el objetivo de sintetizar la evidencia científica reciente sobre los protocolos de tratamiento de la EMC. La literatura reafirma la doxiciclina como el protocolo estándar y fármaco de elección, demostrando alta eficacia en la resolución de signos clínicos complejos, incluidas las lesiones neurológicas multifocales. Además de la antibioticoterapia, el manejo clínico incluye el uso prometedor de terapias adjuvantes, como la N-acetilcisteína (NAC), que actúa como agente antioxidante para potenciar la actividad de la médula ósea y ayudar en la recuperación de la pancitopenia. El monitoreo riguroso de los órganos diana, utilizando biomarcadores como SDMA y UP/C, es crucial para la detección temprana de alteraciones y la prevención de la progresión a enfermedad renal crónica. Se concluye que el éxito en el tratamiento de la ehrlichiosis canina depende de un enfoque integrado, basado en la asociación entre doxiciclina, monitoreo clínico preventivo e intervenciones de soporte dirigidas.

**Palabras clave:** Ehrlichiosis Canina. Doxiciclina. Pancitopenia. N-acetilcisteína. Manejo Clínico.



## 1 INTRODUCTION

Canine monocytic ehrlichiosis (CME) is one of the most relevant infectious diseases in veterinary medicine worldwide, being caused by the obligate intracellular bacterium *Ehrlichia canis* (Lieu Kieu et al., 2025). Transmitted primarily by the tick *Rhipicephalus sanguineus*, the pathology has a global distribution, with a marked prevalence in tropical and subtropical regions due to vector-friendly climatic conditions (Aziz et al., 2023; Lieu Kieu et al., 2025). The clinical severity of CME is variable, progressing from acute self-limiting phases to severe chronic states, characterized by progressive pancytopenia and bone marrow suppression (Yadav et al., 2025).

The therapeutic management of ehrlichiosis requires an integrated approach that contemplates the eradication of the etiological agent and support the systemic damage caused by the infection. In addition to the classic hematological manifestations, recent evidence highlights the impact of the disease on vital organs, such as the development of kidney injury and vasculitis in the central nervous system (Le Sueur et al., 2023; Benito Benito et al., 2025). Given the complexity of the host immune response and bacterial persistence, the establishment of protocols that include adjuvant therapies and close monitoring is essential to improve the prognosis of patients (Yadav et al., 2025; Aziz et al., 2023).

## 2 METHODOLOGY

The present study is characterized as a narrative literature review, developed with the objective of synthesizing and analyzing the most recent scientific evidence related to the therapeutic approach and clinical management protocols in the treatment of canine ehrlichiosis. The search was carried out in the PubMed database, using the descriptors "Ehrlichiosis, Canine" and "Therapeutics", combined through the Boolean operators AND and OR, according to the terminology of Medical Subject Headings (MeSH). Articles published in the last five years, available in full and written in English, that directly addressed the topic were included. Studies that did not have a direct relationship with the central theme, duplicate publications, narrative reviews with low methodological rigor, and articles not indexed in the database used were excluded. The selection of studies was conducted in two stages: screening of titles and abstracts, followed by the evaluation of full texts to confirm relevance. The information extracted was organized in a descriptive manner.



### 3 RESULTS

Contemporary literature reaffirms that the standard protocol for the treatment of canine ehrlichiosis is based on the administration of tetracycline class antibiotics. Doxycycline remains the drug of choice, showing high efficacy in resolving complex clinical signs, such as central nervous system vasculitis, when administered over a period of six weeks (Benito Benito et al., 2025; Aziz et al., 2023). Case studies demonstrate that even multifocal neurological lesions identified by MRI can present complete resolution after doxycycline therapy (Benito Benito et al., 2025).

In addition to antibiotic therapy, advances in clinical management suggest the use of adjuvant therapies to combat agent-induced pancytopenia. The use of N-acetylcysteine (NAC) has shown promise by acting as an antioxidant agent that enhances bone marrow activity, aiding in the recovery of erythrocytes, hemoglobin, and platelet levels (Yadav et al., 2025). With regard to monitoring, early identification of real damage is vital; biomarkers such as SDMA and urinary protein:creatinine ratio (PU/C) are sensitive indicators of glomerular and tubular injury in infected dogs, allowing for early interventions before progression to chronic kidney disease (Le Sueur et al., 2023).

In the preventive and prophylactic field, although vector control with fipronil, permethrin, and afoxolaner remains the primary strategy, research with modified live vaccines (MLAV) shows promising results in experimental models (Aziz et al., 2023; Madesh et al., 2025). Immunization with mutant strains of *Ehrlichia chaffeensis* has been shown to induce a prolonged immune response and protection against tick challenges, indicating a future perspective for biological control of the disease (Madesh et al., 2025).

### 4 DISCUSSION

The academic discussion on the treatment of CME emphasizes the need to transpose the view of treatment focused only on bacterial load to individualized supportive medicine. The chronicity of the infection is strongly associated with the development of immune-mediated glomerulonephritis, which makes renal screening a mandatory protocol in patients with persistent ehrlichiosis (Le Sueur et al., 2023). The genetic heterogeneity of the pathogen, as observed in the diversity of the p28 gene in isolates from different geographic regions, can influence virulence and immune response, challenging the universal standardization of protocols (Lieu Kieu et al., 2025).



Another critical point discussed is the efficacy of hematopoietic support. The use of NAC emerges as a low-cost and highly effective alternative to mitigate oxidative stress in the bone marrow, speeding up the patient's exit from the critical state of pancytopenia (Yadav et al., 2025). The clinical prognosis, although generally favorable in early diagnoses, becomes reserved when there are severe systemic complications or failures in adherence to prolonged antibiotic therapy (Aziz et al., 2023; Benito Benito et al., 2025). In summary, the modern clinical management of canine ehrlichiosis should integrate the eradication of the agent with doxycycline, preventive monitoring of target organs (especially kidneys and nervous system), and the use of metabolic modulators for the restoration of hematological functions (Le Sueur et al., 2023; Yadav et al., 2025).

## 5 CONCLUSION

Canine monocytic ehrlichiosis is characterized as a disease of complex nature, whose treatment requires an approach that goes beyond just eliminating the infectious agent. Although doxycycline remains the treatment of choice and is highly effective, especially when used early, the clinical resolution of the disease is directly related to the ability to integrate the use of antibiotics with individualized support measures.

The progression of the disease from the acute to the chronic form and the development of major complications, such as immune-mediated glomerulonephritis and neurological alterations, reinforce the importance of continuous monitoring of target tissues, especially renal and nervous tissues. In this context, the use of sensitive biomarkers, combined with periodic clinical evaluation, become indispensable tools for the early detection of alterations and for the adoption of more precise therapeutic approaches.

In addition, the use of adjuvant therapies, such as N-acetylcysteine, has shown potential to support hematological recovery, especially in patients with pancytopenia, contributing to the improvement of the prognosis. However, factors such as the genetic variability of the pathogen and the immune response of the host still represent challenges for the standardization of therapeutic protocols.

Thus, it is concluded that success in the treatment of canine ehrlichiosis depends on an integrated approach, based on the association between effective antibiotic therapy, rigorous clinical monitoring, and targeted supportive interventions. Investments in future research, especially in the development of prophylactic strategies, such as vaccines, are



essential to broaden the prospects for control and reduce the impact of the disease on veterinary medicine.

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