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Atypical Mycobacteriosis in a Dog: Case Report and Review of Literature

Micobacteriose Atípica em um Cão: Relato de Caso e Revisão de Literatura

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Abstract

Atypical mycobacterioses in dogs are rare but clinically significant infections caused by non-tuberculous mycobacteria, which are typically acquired from the environment. These opportunistic pathogens induce chronic cutaneous lesions and granulomatous inflammation, which pose diagnostic and therapeutic challenges in routine veterinary practice. This study aimed to report a clinicopathological case of atypical mycobacteriosis in a dog and contextualize the findings through a narrative review of veterinary literature. An 8-year-old female Dachshund presented with multiple nodular and ulcerated skin lesions on the forelimb, mammary gland, and nasal region. A punch biopsy was performed, and histopathological analysis revealed a severe pyogranulomatous inflammatory infiltrate with foamy macrophages, epithelioid cells, and necrotic granulomas. Ziehl-Neelsen staining identified acid-fast bacilli, while fungal stains were negative. These findings support the diagnosis of atypical mycobacteriosis. Due to the lack of follow-up, clinical progression and therapeutic outcomes

could not be evaluated. A complementary narrative review of veterinary literature was conducted to summarize the main epidemiological data, clinical features, diagnostic methodologies, differential diagnoses, and treatment strategies. This review emphasizes the importance of histopathology and acid-fast staining in contexts where advanced diagnostic tools, such as culture or molecular testing, are not available. The prognosis of atypical mycobacterioses in dogs remains variable and is influenced by the extent of the lesions, infecting mycobacterial species, and host response. This case highlights the importance of early recognition, accessible diagnostic methods, and the need for greater clinical awareness to improve outcomes in these underreported infections.

Keywords: Atypical Mycobacteriosis. Dog. Histopathology. Diagnosis. Treatment.

Resumo

As micobacterioses atípicas em cães são infecções raras, porém clinicamente relevantes, causadas por micobactérias não tuberculosas, geralmente adquiridas do ambiente. Esses patógenos oportunistas provocam lesões cutâneas crônicas e inflamação granulomatosa, representando desafios diagnósticos e terapêuticos na prática veterinária. Este estudo teve como objetivo relatar um caso clínico-patológico de micobacteriose atípica em um cão e contextualizar os achados por meio de uma revisão narrativa da literatura veterinária. Uma cadela Dachshund, de oito anos, foi atendida com múltiplas lesões nodulares e ulceradas localizadas no membro torácico, glândula mamária e região nasal. Foi realizada biópsia por punch, e a análise histopatológica revelou infiltrado inflamatório piogranulomatoso severo, com macrófagos espumosos, células epitelioides e granulomas necróticos. A coloração de Ziehl-Neelsen evidenciou bacilos álcool-ácido resistentes, enquanto as colorações para fungos foram negativas. Esses achados confirmaram o diagnóstico de micobacteriose atípica. Não foi possível avaliar a evolução clínica ou resposta terapêutica devido à ausência de retorno do animal. Uma revisão narrativa complementar da literatura foi conduzida, abordando aspectos epidemiológicos, manifestações clínicas, métodos diagnósticos, diagnósticos diferenciais e estratégias terapêuticas. Destaca-se o valor da histopatologia e da coloração para BAAR em contextos com acesso limitado a exames microbiológicos ou moleculares. O prognóstico das micobacterioses atípicas em cães é variável, dependendo da extensão das lesões, da espécie envolvida e da resposta do hospedeiro. Este caso reforça a importância do reconhecimento precoce, do uso de métodos diagnósticos acessíveis e da conscientização clínica para melhores desfechos frente a infecções ainda subnotificadas.

Palavras-chave: Micobacteriose Atípica. Cão. Histopatologia. Diagnóstico. Tratamento.

1 Introduction

Mycobacterial infections in companion animals, particularly atypypical mycobacterioses, represent a significant diagnostic and therapeutic challenge in veterinary medicine. These infections are predominantly caused by non-tuberculous mycobacteria (NTM), including slow-growing species such as the *Mycobacterium avium* complex (MAC) and rapidly growing mycobacteria (RGM) such as *Mycobacterium fortuitum*, *M. smegmatis*, and *M. chelonae* (Sykes, 2025; Faccin *et al*., 2023).

NTM are ubiquitous environmental organisms capable of inducing opportunistic infections, particularly after traumatic skin inoculation (Lemarie, 1999). Clinical manifestations typically involve nodular lesions, ulcerations, draining tracts, and granulomatous to pyogranulomatous

panniculitis, making accurate clinical diagnosis and effective management challenging (Barandiaran *et al*., 2017; Greene, 2025).

In addition to cutaneous involvement, disseminated forms of atypical mycobacteriosis have been documented in dogs, affecting internal organs such as the lungs, lymph nodes, and spleen, often complicating the clinical course (Martinho *et al*., 2013; Sykes *et al*., 2008). The complexity of the disease is further heightened by its chronicity and refractory nature, requiring prolonged and costly treatments with variable prognosis, as previously reported in several studies (Lemarie, 1999; Martinho *et al*., 2013; Sykes *et al*., 2008; Timm *et al*., 2019)

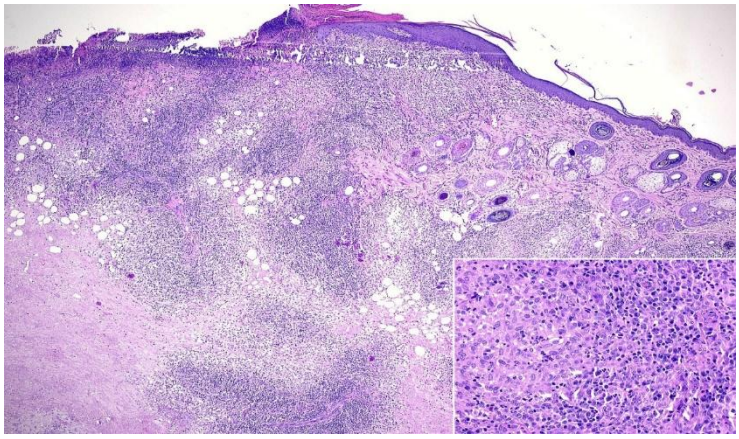
Therefore, this study aimed to report a case of atypical mycobacteriosis in a dog, highlighting the clinical and histopathological findings that supported the diagnosis. Additionally, we sought to contextualize the case by providing a concise narrative review of the veterinary literature on atypical mycobacteriosis in dogs.

2 Case Report

An 8-year-old female Dachshund presented with multiple cutaneous nodules on the forelimb, mammary gland, and nasal region. The nodules were firm and variably sized, with some presenting superficial ulcerations and draining tracts.

A tissue fragment was obtained via punch biopsy, fixed in 10% buffered formalin, and submitted for histopathological analysis. The samples were routinely processed, and 4 µm-thick sections were stained with hematoxylin and eosin (H&E), Grocott-Gomori's methenamine silver stain, and Ziehl-Neelsen (ZN) stain.Histopathological examination revealed diffuse and severe inflammatory infiltrates extensively involving the dermis and subcutaneous tissues. The infiltrate predominantly consisted of abundant foamy and epithelioid macrophages, alongside numerous plasma cells and lymphocytes. Rare multinucleated giant cells were also identified and were frequently associated with discrete granulomas. Within some granulomas, necrotic neutrophils were centrally located, contributing to prominent areas of coagulative and liquefactive necrosis. The epidermis overlying the lesions demonstrated marked hyperplasia characterized by acanthosis and hyperkeratosis, accompanied by extensive epidermal ulceration (Figure 1). Notably, the inflammatory infiltrates extended beyond the surgical margins of excision, suggesting incomplete removal of the affected tissue.

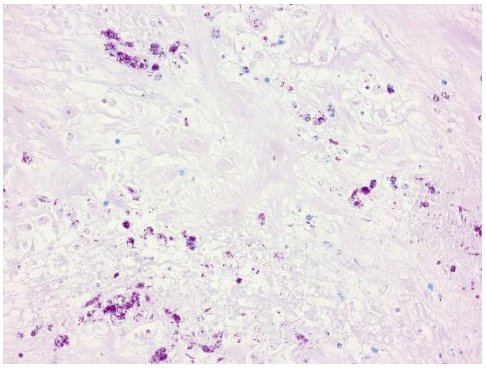
Figure 1 - Overview of skin lesions showing epidermal hyperplasia, hyperkeratosis, ulceration, and dermal necrosis. Inset: Detail of the dermis with a dense pyogranulomatous inflammatory infiltrate



Source: the authors.

Special histochemical stains were employed to rule out fungal pathogens, and Grocott-Gomori's methenamine silver staining yielded negative results. Ziehl-Neelsen (ZN) staining identified the presence of acid-fast bacilli (AFB) (Figure 2). Based on these findings, a diagnosis of atypical mycobacteriosis was made.

Figure 2 - Ziehl-Neelsen staining showing acid-fast bacilli within the granulomatous infiltrate



Source: the authors.

2.1 Discussion

A growing body of veterinary literature has documented the involvement of a wide range of non-tuberculous mycobacteria in atypical infections in dogs. These organisms, primarily acquired from the environment, frequently invade dermal and subcutaneous tissues, particularly following local trauma or invasive procedures. Rapidly growing species such as *Mycobacterium fortuitum*, *M.*

chelonae, and *M. smegmatis* are most often isolated in cutaneous lesions, slow-growing NTM such as those from the *Mycobacterium avium* complex, *M. nebraskense*, and *M. avium* subsp. *avium* have also been implicated in both localized and systemic disease presentations (Sykes, 2025; Faccin *et al*., 2023; Timm *et al*., 2019; Golchin *et al*., 2024; Martinho *et al*., 2013). The varied pathogenic potential of these organisms demands increased clinical awareness and thorough diagnostic assessments. Importantly, in the present case, the diagnosis was achieved through histopathology and Ziehl-Neelsen staining, tools widely available in veterinary pathology laboratories. This highlights the feasibility of diagnosing atypypical mycobacterioses, even in settings with limited access to advanced molecular testing, a reality consistent with the context of many veterinary practices in Brazil.

Definitive species-level identification typically requires culture and molecular techniques, including PCR and 16S rRNA gene sequencing (Timm *et al*., 2019; Barandiaran *et al*., 2017). However, these methods are often unavailable in routine veterinary practice, limiting their diagnostic specificity (Lemarie, 1999; Greene, 2025). In this case, bacterial culture and molecular testing were not performed because of infrastructural limitations, which is a common reality in veterinary clinical settings.

In Brazil, atypical mycobacterioses are not included among the diseases of compulsory notification in human health surveillance systems (Brasil, 2023). Consequently, there is a lack of official epidemiological data regarding their incidence and geographic distributions. Similarly, in veterinary medicine, current knowledge about these infections in dogs is primarily based on isolated case reports documented in the literature, describing their occurrence in various states across the country (Gonçalves *et al*., 2013; Tomelin; Carvalho; Gueretz, 2023).Clinical presentation in dogs often includes nodular or ulcerated cutaneous lesions, draining tracts, and subcutaneous masses (Barandiaran *et al*., 2017; Rocha *et al*., 2016; Foster *et al*., 1986). These findings closely resemble those of the present case. In disseminated cases, respiratory signs, weight loss, and systemic compromise may occur (Sykes *et al*., 2008; Martinho *et al*., 2013).

The clinical evolution and prognosis of atypical mycobacterioses in dogs are highly variable and depend on factors such as the infecting species, lesion extent, host immune response, and early therapeutic interventions. Localized cutaneous forms, especially those caused by rapidly growing mycobacteria such as *Mycobacterium fortuitum* or *M. smegmatis*, may respond favorably to prolonged antimicrobial therapy and, when applicable, surgical debridement (Timm *et al*., 2019; Foster *et al*., 1986). In contrast, disseminated infections, often involving *M. avium* complex or *M. nebraskense*, tend to have a guarded or poor prognosis due to systemic involvement, chronicity, and antimicrobial resistance (Martinho *et al*., 2013; Golchin *et al*., 2024; Sykes, 2025). Clinical improvement may take several months, and relapses are not uncommon, especially when treatment is interrupted prematurely or when antimicrobial susceptibility is unknown (Lemarie, 1999; Greene,

2025). In the present case, however, it was not possible to evaluate clinical progression or the therapeutic response, as the animal did not return for follow-up consultations, a circumstance that is unfortunately not rare in routine clinical practice. This highlights an additional challenge in managing such infections and reinforces the need for patient education and long-term clinical monitoring.

Histologically, granulomatous or pyogranulomatous panniculitis predominates, with variable necrosis and occasional detection of AFB (Lemarie, 1999; Martinho *et al*., 2013). In most veterinary diagnostic laboratories, histopathology remains the primary tool for diagnosing atypical mycobacterioses, as advanced microbiological culture and molecular identification techniques are often unavailable or impractical for routine use (Lemarie, 1999; Barandiaran *et al*., 2017; Greene, 2025). Similar histopathological patterns were observed in this case, with discrete granulomas formed by foamy macrophages, epithelioid cells, and multinucleated giant cells surrounding necrotic areas. Additionally, Ziehl-Neelsen staining in this case was positive for acid-fast bacilli, further supporting the diagnosis of atypical Mycobacterium. However, recent evidence has highlighted that ZN staining may yield false-negative results, especially in cases with low bacterial loads or fragmented bacilli, reinforcing that negative ZN results do not rule out mycobacterial infection when histological features are suggestive (Huupponen *et al*., 2025).

Differential diagnoses include deep bacterial infections, such as actinomycosis and nocardiosis, which are characterized by filamentous gram-positive organisms; cutaneous leishmaniasis, identified by intrahistiocytic amastigotes; and sterile or bacterial pyogranulomas, lacking AFB and the granulomatous pattern observed in this case (Faccin *et al*., 2023; Sykes, 2025). Although rare, tuberculosis complex infections must also be considered because of their zoonotic potential, as previously documented in dogs (Rocha *et al*., 2016; Sykes *et al*., 2008).

Pharmacological treatment of atypypical mycobacteriosis involves long-term administration of antimicrobials effective against NTM. Protocols commonly include macrolides (clarithromycin or azithromycin), rifampicin, and fluoroquinolones (pradofloxacin or enrofloxacin) (Sykes, 2025; Greene, 2025; Timm *et al*., 2019). In the reviewed cases, the treatment duration varied from several months to over a year, often combined with surgical intervention (Foster *et al*., 1986; Timm *et al*., 2019). However, treatment is hampered by drug resistance, intracellular localization of mycobacteria, and limited access to susceptibility testing (Lemarie, 1999; Martinho *et al*., 2013; Golchin *et al*., 2024).

Although cutaneous mycobacteriosis poses no significant zoonotic risk when caused by NTM, infections by *Mycobacterium bovis* or *M. tuberculosis* complex organisms should be promptly reported to public health authorities because of their zoonotic potential (Rocha *et al*., 2016; Sykes *et al*., 2008). Preventive measures and owner education are essential in such cases.

3 Conclusion

Atypical mycobacterioses in dogs are uncommon yet clinically relevant infections that often pose diagnostic and therapeutic challenges owing to their nonspecific presentation and limited access to advanced diagnostic methods. This study contributes to the literature by reporting a clinicopathological case confirmed through histopathology and Ziehl-Neelsen staining, methods accessible in most veterinary laboratories. Furthermore, the accompanying narrative review of the literature reinforces key epidemiological, clinical, and diagnostic aspects, providing an updated context for veterinarians facing similar cases. Emphasizing early recognition, histological investigation, and long-term management strategies may improve patient outcomes and promote more effective case reporting in veterinary practices.

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