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Emergency management of severe anemia due to presumptive *Babesia vogeli* in a Puppy: Whole blood transfusion and doxycycline monotherapy

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Abstract

Aim: To document the successful clinical management of life-threatening hemolytic anemia caused by a presumptive *Babesia vogeli* infection in a puppy and to describe the clinical and hematological response to emergency whole-blood transfusion combined with doxycycline monotherapy.

Case Presentation: A two-month-old male puppy was presented to the Small Animal Outpatient Medicine Unit with severe lethargy, recumbency and icterus. Clinical examination revealed heavy tick infestation and a life-threatening Packed Cell Volume (PCV) of 10%. Peripheral blood smears confirmed the presence of large forms of intra-erythrocytic piroplasms morphologically consistent with *Babesia* spp. (presumptive *B. vogeli*). The patient was stabilized with an emergency whole-blood transfusion (45 mL) and initiated on doxycycline therapy (5 mg/kg IV for five days, followed by 10 mg/kg orally for 21 days). Within 24 hours, clinical improvement was noted, and by Day 4, the PCV had increased to 28%.

Discussion: While *B. vogeli* is typically considered to have mild to moderate pathogenicity in adult dogs, this case underscores its potential to cause high pathogenicity in puppies. The rapid stabilization provided by the blood transfusion was critical, as it allowed the pup to survive the severe hypoxic crisis. Doxycycline monotherapy appeared to be a viable therapeutic strategy in this case, potentially suppressing the parasite burden while avoiding the safety risks associated with imidocarb in very young or debilitated puppies.

Conclusion: Prompt diagnosis and timely blood transfusion are life-saving interventions in puppies with severe babesiosis. This case suggests that early intervention combined with doxycycline and supportive care can lead to successful clinical outcomes in acute, life-threatening suspected *B. vogeli* infections.

Keywords: *Babesia vogeli*, canine babesiosis, whole blood transfusion, doxycycline, puppy

Introduction

Babesia vogeli is a large, mild to moderate pathogenic subspecies of *Babesia* that infects dogs (Solano-Gallego *et al.*, 2016, Sharma *et al.*, 2025) [13, 12]. It is morphologically characterized by large intraerythrocytic, piriform (teardrop-shaped, $2.5 \times 4.0 \mu\text{m}$) piroplasms occurring either single or in pairs. The parasite is primarily transmitted by the brown dog tick, *Rhipicephalus sanguineus*, an endophilic and monotrophic species commonly inhabiting human dwellings, kennels, and environments where dogs and people live in close contact. While *B. vogeli* infection generally produces mild to moderate subclinical disease in adult dogs, severe clinical manifestations may occur, particularly in young, debilitated, or immunocompromised animals. The pathogenicity in puppies is often exacerbated by the immaturity of their immune systems and lower splenic reserve, resulting in poor clearance of infected erythrocytes.

Management of canine babesiosis typically involves specific antiprotozoal agents such as imidocarb dipropionate or diminazene aceturate, often combined with doxycycline or clindamycin to enhance therapeutic efficacy and control concurrent tick-borne infections (Solano-Gallego *et al.*, 2016, Karasov *et al.*, 2022) [13, 6]. However, in cases presenting with severe hemolytic anemia—where the Packed Cell Volume (PCV) falls below critical thresholds—emergency stabilization with whole blood transfusion is essential to restore

oxygen-carrying capacity and improve immediate survival, particularly in critically anemic puppies (Aravindh & Jacob, 2021; Dadke & Galdhar, 2021; Reddy *et al.*, 2024) ^[1, 5, 10]. The present report describes the successful emergency management of a life-threatening presumptive *B. vogeli* infection in a two-month-old puppy using whole-blood transfusion and doxycycline monotherapy. This case highlights the importance of early intervention and the efficacy of targeted supportive care in managing critically anemic pediatric patients.

Case Presentation

A 2-month-old male mixed-breed puppy weighing 2.2 kg was presented to the Small Animal Clinics–Outpatient Medicine Unit, VCRI, Tirunelveli, with a history of progressive weakness, inappetence and blanched mucous membranes. Upon physical examination, the puppy was dull, weak and recumbent. Clinical findings included marked pallor of the mucous membranes and icterus. Vital parameters revealed a body temperature of 35°C, heart rate of 120 beats/min, and a respiratory rate of 15 breaths/min. A heavy infestation of *Rhipicephalus sanguineus* ticks was also noted.

Hematological evaluation confirmed life-threatening anemia with a Packed Cell Volume (PCV) of 10% and hemoglobin of 3.3 g/dL. Severe thrombocytopenia (40,000 / μ L) was also evident, consistent with hemolytic anemia. This hematological alteration is consistent with clinicopathological findings reported in canine babesiosis (Bilwal *et al.*, 2017; Rafaj *et al.*, 2006) ^[2, 9]. Peripheral blood smear examination by Giemsa stain demonstrated large forms of intraerythrocytic piroplasms (2.5 $\times$ 4.0 μ m) morphologically consistent with *Babesia* spp. Given the local prevalence and vector presence, a presumptive diagnosis of *Babesia vogeli* was made.

Upon identifying the critical status of the patient, an emergency whole-blood transfusion was prioritized. A total of 100 mL of blood was collected aseptically from the jugular vein of a clinically healthy, adult donor dog into a CPDA-1 anticoagulant blood collection bag (Fig. 1). The required transfusion volume was calculated using the following formula:

$$V = (BW \times 90 \times (PCV_{(desired)} - PCV_{(recipient)})) \div PCV_{(donor)}$$

Where V is the volume to be transfused (mL) and BW is the body weight (kg). Due to the emergency nature of the case and the fact that this was the patient's first lifetime transfusion, cross-matching was not performed. However, transfusion protocols recommend compatibility testing whenever feasible to prevent transfusion reactions and transmission of blood-borne pathogens (Stegeman *et al.*, 2003; Aravindh & Jacob, 2021) ^[14, 1]. Transfusion was initiated at a conservative rate of six drops per minute for the first 10 minutes under close hemodynamic monitoring to detect any acute hemolytic reactions. Upon ensuring stability, the infusion rate was increased to 20 drops per minute, allowing administration of a total of 45 mL of whole blood over one hour.

Significant clinical improvement, including a return of appetite and increased activity, was observed within 24 hours post-transfusion. A follow-up complete blood count on Day 4 revealed a PCV increase to 28%, confirming a successful hematological response.

Post-transfusion therapeutic management consisted of doxycycline administered intravenously at 5 mg/kg once daily

for five days, followed by oral administration at 10 mg/kg for an additional 21 days. Adjunctive therapy included intravenous fluid therapy, hematinics and nutritional supplementation. While standard protocols often combine doxycycline with imidocarb dipropionate, this patient showed complete clinical and hematological recovery with doxycycline monotherapy and supportive care. The puppy was monitored for seven days post-treatment, showing sustained recovery and no recurrence of anemia.

Discussion

Canine babesiosis is a globally significant and potentially life-threatening hemoprotozoan disease (Selim *et al.*, 2022) ^[11]. While *Babesia rossi* is traditionally viewed as the most virulent species, *B. vogeli*—transmitted by the ubiquitous brown dog tick *Rhipicephalus sanguineus*—is increasingly recognized for its severe clinical impact on specific populations (Coralic *et al.*, 2018) ^[4]. Although this protozoan is described as a mildly pathogenic or subclinical subspecies in adults (Koster *et al.*, 2015) ^[7], this case corroborates findings by Wang *et al.* (2018) ^[15] that

B. vogeli can induce fatal hemolytic crises in pediatric, debilitated, or immunocompromised hosts. The diagnosis in this patient was based on the triad of clinical presentation, severe hematological derangement, and microscopic identification of large piroplasms. While PCR confirmation was not available to definitively differentiate *B. vogeli* from other large *Babesia* species, the morphology and vector association strongly support the presumptive diagnosis. The observed anemia was likely multifactorial, resulting from direct parasite-induced erythrocyte membrane damage, increased osmotic fragility and immune-mediated hemolysis (Boozer & Macintire, 2003) ^[3].

A critical intervention in this case was the emergency whole-blood transfusion. In patients presenting with a PCV as low as 10%, immediate restoration of oxygen-carrying capacity is essential to prevent tissue hypoxia and potential multi-organ failure. The marked clinical improvement observed within 24 hours post-transfusion highlights that stabilization of the red blood cell mass is often the most crucial step in managing acute pediatric cases of severe babesiosis.

Tick-borne blood pathogen infections in puppies pose a significant therapeutic challenge due to immature hepatic and renal function, increased susceptibility to drug toxicity, and frequent presentation with severe anemia. Although standard treatment for *Babesia vogeli* typically includes imidocarb dipropionate or diminazene aceturate, their use in very young dogs warrants caution. In the present case, doxycycline monotherapy was utilized to achieve pathogen control while minimizing drug-related risks.

Doxycycline exhibits anti-*Babesia* activity, likely through the inhibition of apicoplast protein synthesis, a mechanism similar to its action in other apicomplexan parasites (Mittal *et al.*, 2025) ^[8]. When combined with aggressive supportive management, including blood transfusion, doxycycline appeared sufficient to assist in clinical stabilization and hematologic recovery. This approach is particularly relevant in puppies and in settings where access to potent antiprotozoals may be limited or contraindicated.

Clinical and experimental evidence supports this strategy. Wongtawan *et al.* (2024) ^[16] reported PCR-confirmed clearance of tick-borne pathogens following doxycycline monotherapy, with marked improvement in hematological profiles. Similarly, experimental studies have demonstrated pathogen reduction with doxycycline treatment (Zhang *et al.*,

2023)^[17]. However, it is important to note that without PCR confirmation of clearance, it is difficult to determine if the parasite was eliminated or if the dog achieved a carrier state while clinical signs resolved.

Overall, doxycycline monotherapy (10 mg/kg/day for 28 days), combined with appropriate supportive care, represents a rational and safer therapeutic option for puppies with suspected tick-borne blood pathogen infections, particularly when conventional antiprotozoal regimens pose safety risks.



Fig 1: blood bag

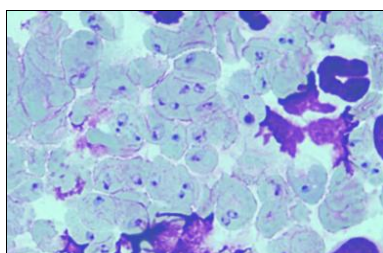


Fig 2: Peripheral blood smear showing large intraerythrocytic piroplasms within RBC



Fig 3: Recipient dog

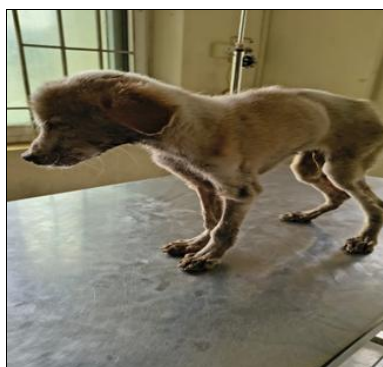


Fig 4: Recipient dog after recovery

Conclusion

This case emphasizes that *Babesia vogeli* should not be dismissed as "mildly pathogenic" in pediatric veterinary medicine. A 10% PCV represents a life-threatening emergency that necessitates immediate whole-blood

transfusion. The successful recovery of this two-month-old puppy demonstrated that a protocol of early diagnosis, emergency stabilization via transfusion, and doxycycline monotherapy is a highly effective management strategy. Clinicians should maintain a high index of suspicion for babesiosis in anemic puppies with tick exposure, regardless of the subspecies involved.

Conflict of Interest

Not available

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