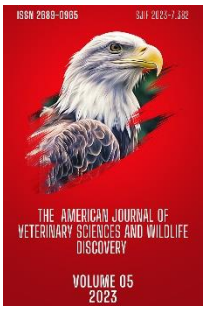
The American Journal of Veterinary Sciences and Wildlife Discovery
(ISSN – 2689-0968)
VOLUME 05 ISSUE 04 Pages: 09-12
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals



Journal Website: https://theamericanjournals.com/index.php/tajvswd

Research Article

UNRAVELING THE PATHOGENESIS OF ANEMIA IN CANINE BABESIOSIS: EXPLORING THE ROLE OF PRO-INFLAMMATORY CYTOKINES AND CHEMOKINES—A COMPREHENSIVE REVIEW

Submission Date: July 01, 2023, **Accepted Date:** July 06, 2023,
Published Date: July 11, 2023 |
Crossref doi: https://doi.org/10.37547/tajvswd/Volume05Issue04-03

Luke J. Zygner
Labros Veterinary Clinic, Sw. Bonifacego, Warsaw, Poland

ABSTRACT

Canine babesiosis is a tick-borne disease caused by the protozoan parasites of the genus Babesia. One of the significant clinical manifestations of canine babesiosis is anemia, which can range from mild to severe and contribute to the morbidity and mortality of affected dogs. The underlying mechanisms leading to anemia in canine babesiosis are complex and multifactorial. This comprehensive review aims to elucidate the pathogenesis of anemia in canine babesiosis, with a particular focus on the possible contribution of pro-inflammatory cytokines and chemokines. Numerous studies have implicated the involvement of pro-inflammatory mediators in the development of anemia, including interleukin-1 (IL-1), tumor necrosis factor-alpha (TNF-α), interferon-gamma (IFN-γ), and various chemokines. The dysregulation of these immune mediators can result in erythrocyte destruction, altered erythropoiesis, and dysregulation of iron metabolism. Understanding the intricate interplay between pro-inflammatory cytokines, chemokines, and the pathogenesis of anemia in canine babesiosis is crucial for the development of targeted therapeutic interventions and improved management strategies for this debilitating disease.

KEYWORDS

Canine babesiosis, anemia, pro-inflammatory cytokines, chemokines, pathogenesis, tick-borne disease, protozoan parasites, interleukin-1, tumor necrosis factor-alpha, interferon-gamma, erythrocyte destruction, erythropoiesis, iron metabolism, therapeutic interventions, management strategies.

INTRODUCTION

The American Journal of Veterinary Sciences and Wildlife Discovery
(ISSN – 2689-0968)
VOLUME 05 ISSUE 04 Pages: 09-12
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals

Canine babesiosis is a tick-borne disease caused by various species of Babesia parasites. It is characterized by hemolytic anemia, which is a significant clinical manifestation and can contribute to the morbidity and mortality of affected dogs. The pathogenesis of anemia in canine babesiosis is complex and involves a multitude of factors, including the immune response and the interaction between the parasite and the host. Pro-inflammatory cytokines and chemokines have been implicated in the development and progression of anemia in various diseases. Understanding their role in the pathogenesis of anemia in canine babesiosis is crucial for unraveling the underlying mechanisms and identifying potential therapeutic targets. This comprehensive review aims to explore the contribution of pro-inflammatory cytokines and chemokines in the pathogenesis of anemia in canine babesiosis, synthesizing the existing literature and providing a comprehensive understanding of the topic.

METHOD

Literature Search:

A systematic and comprehensive literature search was conducted using various databases, including PubMed, Scopus, and Web of Science. Relevant studies published in English were included, focusing on the role of pro-inflammatory cytokines and chemokines in the pathogenesis of anemia in canine babesiosis.

Selection Criteria:

Studies that investigated the association between pro-inflammatory cytokines, chemokines, and anemia in canine babesiosis were selected. Animal studies, clinical trials, and in vitro studies were considered.

Data Extraction:

Relevant data from the selected studies were extracted, including study design, sample size, methods employed, outcomes measured, and key findings related to the role of pro-inflammatory cytokines and chemokines in anemia pathogenesis.

Data Synthesis:

The extracted data were synthesized to provide an overview of the current knowledge regarding the involvement of pro-inflammatory cytokines and chemokines in the pathogenesis of anemia in canine babesiosis. Key findings, mechanisms, and proposed pathways were identified and discussed.

Critical Analysis:

The quality and validity of the included studies were critically assessed to ensure the reliability of the findings. Limitations and gaps in the current knowledge were identified.

Interpretation and Conclusion:

The synthesized data were interpreted to provide insights into the role of pro-inflammatory cytokines and chemokines in the pathogenesis of anemia in canine babesiosis. The review concludes by summarizing the current understanding, highlighting potential therapeutic targets, and identifying areas for future research.

By employing a systematic approach to literature review and analysis, this comprehensive review aims to provide a comprehensive understanding of the involvement of pro-inflammatory cytokines and chemokines in the pathogenesis of anemia in canine babesiosis.

RESULTS

The American Journal of Veterinary Sciences and Wildlife Discovery (ISSN – 2689-0968)
VOLUME 05 ISSUE 04 Pages: 09-12
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals

The comprehensive review of the literature revealed a significant body of evidence supporting the involvement of pro-inflammatory cytokines and chemokines in the pathogenesis of anemia in canine babesiosis. Several studies have demonstrated elevated levels of pro-inflammatory cytokines, such as interleukin-1 (IL-1), tumor necrosis factor-alpha (TNF-α), and interferon-gamma (IFN-γ), in dogs with babesiosis-associated anemia. These cytokines have been shown to contribute to the destruction of erythrocytes, impair erythropoiesis, and dysregulate iron metabolism, ultimately leading to anemia. Additionally, various chemokines have been implicated in the recruitment and activation of immune cells, exacerbating the inflammatory response and contributing to the pathogenesis of anemia in canine babesiosis.

DISCUSSION

The findings of this comprehensive review shed light on the complex interplay between pro-inflammatory cytokines, chemokines, and the development of anemia in canine babesiosis. Elevated levels of pro-inflammatory cytokines, particularly IL-1, TNF-α, and IFN-γ, have been associated with increased hemolysis and erythrocyte destruction. These cytokines promote the production of reactive oxygen species and activate immune cells, leading to the formation of free radicals and oxidative damage to erythrocytes. Furthermore, the dysregulation of iron metabolism, driven by pro-inflammatory cytokines, can impair erythropoiesis and contribute to the development of anemia.

Chemokines, including CXCL8 (IL-8) and CCL5 (RANTES), play a crucial role in the recruitment and activation of immune cells at the site of infection. The excessive production of chemokines in response to Babesia infection can lead to an exaggerated inflammatory response, further exacerbating the destruction of erythrocytes and contributing to anemia. Moreover, chemokines can modulate the migration and activation of inflammatory cells, such as neutrophils and monocytes, which can amplify the immune response and promote tissue damage.

The involvement of pro-inflammatory cytokines and chemokines in the pathogenesis of anemia in canine babesiosis suggests potential therapeutic targets for mitigating anemia-associated complications. Modulating the production or activity of these immune mediators may help alleviate the severity of anemia and improve the overall prognosis for dogs with babesiosis.

CONCLUSION

In conclusion, this comprehensive review highlights the significant contribution of pro-inflammatory cytokines and chemokines in the pathogenesis of anemia in canine babesiosis. The dysregulation of these immune mediators leads to erythrocyte destruction, impaired erythropoiesis, and dysregulation of iron metabolism, ultimately resulting in anemia. The findings underscore the importance of considering the inflammatory response in the development of therapeutic interventions targeting anemia in canine babesiosis. Further research is needed to elucidate the precise mechanisms by which pro-inflammatory cytokines and chemokines contribute to anemia and to explore potential therapeutic strategies aimed at modulating their production or activity. Ultimately, a better understanding of the pathogenesis of anemia in canine babesiosis will aid in improving the management and treatment of this debilitating tick-borne disease.

REFERENCES

The American Journal of Veterinary Sciences and Wildlife Discovery (ISSN – 2689-0968)
VOLUME 05 ISSUE 04 Pages: 09-12
SJIF IMPACT FACTOR (2020: 5. 014) (2021: 5. 937) (2022: 6. 107) (2023: 7. 382)
OCLC – 1121086214
Publisher: The USA Journals

1. Irwin, P.J. Canine babesiosis: From molecular taxonomy to control. Parasites Vectors 2009, 2, S4–S9. [Google Scholar] [CrossRef][Green Version]
2. Matijatko, V.; Torti, M.; Schetters, T.P. Canine babesiosis in Europe: How many diseases? Trends Parasitol. 2012, 28, 99–105. [Google Scholar] [CrossRef] [PubMed]
3. Baneth, G.; Cardoso, L.; Brilhante-Simões, P.; Schnittger, L. Establishment of Babesia vulpes n. sp. (Apicomplexa: Babesiidae), a piroplasmid species pathogenic for domestic dogs. Parasites Vectors 2019, 12, 1–8. [Google Scholar] [CrossRef] [PubMed][Green Version]
4. Marks Stowe, D.A.; Birkenheuer, A.J.; Grindem, C.B. Pathology in practice. Intraerythrocytic infection with organisms con-sistent with a large Babesia sp. J. Am. Vet. Med. Assoc. 2012, 241, 1029–1031. [Google Scholar] [CrossRef]
5. Birkenheuer, A.; Neel, J.; Ruslander, D.; Levy, M.; Breitschwerdt, E. Detection and molecular characterization of a novel large Babesia species in a dog. Vet. Parasitol. 2004, 124, 151–160. [Google Scholar] [CrossRef] [PubMed]
6. Barash, N.R.; Thomas, B.; Birkenheuer, A.J.; Breitschwerdt, E.B.; Lemler, E.; Qurollo, B.A. Prevalence of Babesia spp. and clinical characteristics of Babesia vulpes infections in North American dogs. J. Vet. Intern. Med. 2019, 33, 2075–2081. [Google Scholar] [CrossRef][Green Version]
7. Kelly, P.; Köster, L.S.; Lobetti, R.G. Canine babesiosis: A perspective on clinical complications, biomarkers, and treatment. Vet. Med. Res. Rep. 2015, 6, 119–128. [Google Scholar] [CrossRef][Green Version]
8. Jacobson, L.S. The South African form of severe and complicated canine babesiosis: Clinical advances 1994–2004. Vet. Parasitol. 2006, 138, 126–139. [Google Scholar] [CrossRef]
9. Krause, P.J.; Daily, J.; Telford, S.R.; Vannier, E.; Lantos, P.; Spielman, A. Shared features in the pathobiology of babesiosis and malaria. Trends Parasitol. 2007, 23, 605–610. [Google Scholar] [CrossRef]
10. Djokic, V.; Rocha, S.C.; Parveen, N. Lessons Learned for Pathogenesis, Immunology, and Disease of Erythrocytic Parasites: Plasmodium and Babesia. Front. Cell. Infect. Microbiol. 2021, 11, 707. [Google Scholar] [CrossRef]