INTERNATIONAL SEVEN JOURNAL
OF MULTIDISCIPLINARY
ISSN: 2764-9547

CORRELATION BETWEEN FELV INFECTION AND FIV AND THE DEVELOPMENT OF HEMATOPOIETIC NEOPLASMS IN FELINES

https://doi.org/ 10.56238/isevmjv4n2-024

Receipt of originals: 03/28/2025 **Acceptance for publication:** 04/28/2025

Richardson Maia Felipe[1], Ana Paula de Moura Nardi[2], Maria Aline Leitão Scatambuli[3], Francisco Ítalo Cassiano Candido[4], Marcos Vinicius Vidal Silva[5], Isabella Silva Borges[6], João Paulo Yoshio Prado Cerqueira Kubota[7], Amanda Ferreira de Jesus[8], Lourdes Maria Bento Campello[9], Livia Mara Guerra Diniz[10], Gabrielly de Lima Silva[11], Elisa Pereira Sarlo[12], Edson Farias[13],

[1]Undergraduate student in Veterinary Medicine
Potiguar University – UNP
E-mail: richardsonmaiafelipe2@gmail.com
[2]Undergraduate student in Veterinary Medicine
Cristo Rei- Faccrei Colleges
E-mail: apdemouranardi@gmail.com
[3]Undergraduate student in Veterinary Medicine
Federal University of Mato Grosso
E-mail: maria-aline-scatambuli@hotmail.com
[4]Undergraduate student in Veterinary Medicine
State University of Ceará - Itaperi Campus
E-mail: franciscoitalo.cc@gmail.com
[5]Undergraduate student in Veterinary Medicine
Federal University of Campina Grande
Email: zzaiffo@gmail.com
[6]Master's student in Animal Science
Federal University of Goiás
E-mail: isabella_borges2@discente.ufg.br
[7]Doctorate student in Animal Science
Federal University of Goiás
E-mail: jpyoshiok@gmail.com
[8]Master's student in Animal Science
Federal University of Goiás
E-mail: amandaferreira@discente.ufg.br
[9]Undergraduate student in Veterinary Medicine
Fluminense Federal University
E-mail: lcampello@id.uff.br
[10]Undergraduate student in Veterinary Medicine
Faculdade Rebouças - CG
E-mail: liviaguerra.doc@gmail.com
[11]Undergraduate student in Veterinary Medicine
Federal University of Santa Catarina
E-mail: lima.gabrielly@hotmail.com
[12]Graduated in Veterinary Medicine
Vila Velha University
E-mail: elisapereirasarlo@gmail.com
[13]Undergraduate student in Veterinary Medicine
Anclivepa DF
Email: edsonfarias1990@gmail.com

INTERNATIONAL SEVEN JOURNAL
OF MULTIDISCIPLINARY
ISSN: 2764-9547

Marcos Henrique da Silva[14], Jéssica Caloraine Trelha dos Santos[15], Luana Henriques Costa[16] and Natália Araujo de Lima[17]

ABSTRACT

Objective: To examine the correlation between FeLV (feline leukemia virus) and FIV (feline immunodeficiency virus) retrovirus infections and the development of hematopoietic neoplasms in felines, focusing on the clinical and prognostic implications of these infections. Hematopoietic neoplasms, especially lymphomas and leukemias, are frequent in felines, with retroviruses playing critical roles in oncogenesis. FeLV has direct oncogenic action, while IVF promotes oncogenesis by immunosuppression. This study was conducted through a narrative review of the literature, including scientific articles, monographs, and case reports. The results revealed that FeLV-positive cats have a higher risk of multicentric lymphomas, while those infected by FIV have a higher predisposition to foodborne lymphomas. Co-infection with both retroviruses significantly increases the risk of developing lymphomas and leukemias. Modern diagnostic approaches such as PCR-PARR and flow cytometry are essential for staging and targeted treatment. Treatment with chemotherapy protocols, such as COP and CHOP, offers temporary control, but survival rates remain low. It is concluded that it is essential to implement prevention and serological testing programs to reduce the prevalence of retroviruses and associated neoplasms.

Keywords: Diagnosis. Lymphoma. Leukaemia. Oncogenesis. Retrovirus.

[14]Graduated in Veterinary Medicine
State University of Londrina
Email: marcos.henriquee@uel.br
[15]Graduated in Veterinary Medicine
Brazilian University Center
E-mail: jessicatrelha@hotmail.com
[16]Undergraduate student in Veterinary Medicine
Mauritius University Center of Nassau
Email: ccostalu99@gmail.com
[17]Undergraduate student in Veterinary Medicine
Castelo Branco University
Email: nataliaaraujocitop@gmail.com

INTRODUCTION

In recent decades, neoplastic diseases in felines have become one of the main causes of morbidity and mortality, following the trend observed in pets in general (Salvado, 2010). Hematopoietic neoplasms, especially lymphoma, are particularly prominent, accounting for up to 90% of all hematopoietic neoplasms and 20% to 30% of all malignancies in the species (Geine-Romanova and Houtana, 2023; Sunpongsri *et al*., 2022). This tumor arises from the uncontrolled multiplication of lymphocytes and can affect lymph nodes, visceral organs and non-lymphoid tissues, presenting diverse and challenging clinical manifestations (Daleck, De Nardi and Rodaski, 2008).

The retroviruses FeLV (feline leukemia virus) and FIV (feline immunodeficiency virus) are significant risk factors for the development of these neoplasms (Jarrett *et al*., 1964; Pedersen *et al*., 1987). FeLV, in addition to provoking immunosuppression, acts as a direct oncogenic agent, incorporating its genetic material into the DNA of the host cell (Fujino, Ohno, and Tsujimoto, 2008; Mello, 2022). On the other hand, IVF indirectly assists in oncogenesis through progressive immunosuppression, favoring the survival and growth of atypical cell clones (Dalek and Nardi, 2016; Cunha, 2018).

Epidemiological data indicate that FeLV infection increases the probability of developing lymphoma by up to 60 times (Sunpongsri et al., 2022; Lopes et al., 2025), while FIV infection increases the risk by 5 to 14 times (Shelton et al., 1990; Gabor et al, 2001). Co-infection intensifies this situation, increasing the susceptibility to neoplasia in felines to levels greater than 75 times compared to healthy individuals (Nelson and Couto, 2010). In addition, in infected animals, the evolution of the disease and the clinical prognosis tend to be more adverse, as demonstrated by Lopes *et al*. (2025) and Cunha (2018), who reported adverse clinical outcomes, even in the face of specific chemotherapy protocols.

In routine clinical and autopsy, FeLV is more linked to multicentric lymphomas and leukemias, while IVF is linked to foodborne lymphomas and less aggressive lymphoproliferative conditions (Mello, 2022; Cunha, 2018). It is crucial to emphasize that, although diagnostic and vaccination campaigns have decreased the incidence of FeLV in developed nations, the infection is still significant in Brazil, with prevalences of up to 30.1% for FeLV and 23.3% for FIV (Costa et al., 2017; Feitosa et al., 2021).

Considering the clinical and epidemiological relevance of these retroviruses in feline oncogenesis, it is crucial to understand the relationship between the presence of

these agents and the emergence of neoplasms. Therefore, the objective of this article is to examine the relationship between FeLV infection and FIV and the emergence of hematopoietic neoplasms in felines, compiling information from necroscopy studies and case reports, in order to understand the extent of this link and its clinical and prognostic consequences. hematopoietic surgeries, for better guidance in diagnosis, prognosis and treatment.

METHODOLOGY

The methodology of this work consisted of conducting a narrative review of the literature, based on the analysis of scientific articles, monographs and case reports related to the correlation between infections by FeLV and FIV retroviruses and the development of hematopoietic neoplasms in domestic felines. Three previously selected academic documents were used as a basis, consisting of two case reports and a retrospective research, in addition to the references cited in these works, which complemented the theoretical foundation.

To ensure the relevance and timeliness of the information, inclusion and exclusion criteria were established. Studies published in the last twenty years that addressed domestic felines naturally infected by FeLV and/or FIV, correlating these infections with the emergence of lymphomas, leukemias, or other hematopoietic neoplasms, were included in the review. Only full-access studies, available in Portuguese or English, and presenting clinical or autopsy data related to these diseases were considered. Studies carried out exclusively with experimental models, studies focused on wild cats or other species, articles that did not show a direct relationship between retroviral infection and hematopoietic neoplasms, and publications with incomplete, duplicated, or unvalidated data were excluded from the analysis. The selected material was analyzed qualitatively, with emphasis on the clinical, diagnostic and prognostic characteristics of retrovirus-associated neoplasms, in addition to the therapeutic response reported in the cases.

RESULTS AND DISCUSSIONS

Retroviruses in felines, particularly FeLV infection and FIV, are significant pathogens in feline medicine, causing a wide range of immunological, hematological and oncological changes (Jarrett *et al.,* 1964; Pedersen *et al*., 1987; Cunha, 2018;

Mello, 2022). FeLV, a retrovirus of the genus *Gammaretrovirus*, identified in the 1960s, has a direct effect on feline oncogenesis. On the other hand, FIV, a retrovirus of the genus *Lentivirus*, identified more recently, acts indirectly, favoring animals to opportunistic diseases and secondary tumors due to immune suppression (Dalek and Nardi, 2016; Cunha, 2018).

Contamination by FeLV occurs mainly through direct, oronasal contact between susceptible animals and contaminated secretions, being more common in places with high population density and young cats (Hardy *et al*., 1974; Mello, 2022). On the other hand, FIV is spread mainly through bites, which is why it is more common in adult, non-neutered male cats with access to the street (Medeiros *et al*., 2012; Cunha, 2018).

Both viruses have a global distribution, with differences in prevalence rates according to region, sanitary control, and the socioeconomic profile of human and feline populations. In Brazil, there are records of prevalences of up to 30.1% of FeLV and 23.3% of IVF (Costa *et al*., 2017; Feitosa *et al*., 2021). These rates are higher than those recorded in advanced nations such as Germany, Canada, and the United States, where rates do not exceed 5% for both viruses (Levy *et al.,* 2006; Gleich, Krieger and Hartmann, 2009; Little et al., 2009).

FeLV has a recognized direct oncogenic potential, due to the incorporation of its DNA into the genome of the host cell (Fujino, Ohno and Tsujimoto, 2008). This fusion occurs in areas close to proto-oncogenes such as c-myc, pim-1 and bmi-1, promoting proliferative activation and loss of cell control (Cunha, 2018). This process promotes the development of hematopoietic and non-hematopoietic tumors, with lymphomas and myeloid leukemia being the most frequent (Mello, 2022). Research indicates that cats infected with FeLV have up to a 60-fold higher risk of developing lymphoma compared to uninfected animals (Sunpongsri et al., 2022; Lopes et al., 2025). In addition, the virus compromises cellular immunity, predisposing individuals to bacterial, viral, fungal, and parasitic co-infections, increasing morbidity and mortality (Hartmann, 2011; Mello, 2022).

On the other hand, IVF does not directly affect oncogenes, but causes progressive immunosuppression through the decrease of CD4+ T lymphocytes, modification in the function of CD8+ T lymphocytes, and impairment of immune monitoring (Dalek and Nardi, 2016) This immunosuppression scenario favors the emergence of atypical cell clones, making it more difficult to remove cells with genetic

modifications and facilitating the formation of tumors, especially lymphomas (Cunha, 2018). FIV infection increases the probability of lymphoma by 5 to 14 times (Shelton *et al*., 1990; Gabor *et al*., 2001), being more common in adult cats, which usually exhibit feeding or multicentric forms (Cunha, 2018).

Clinical research and necropsies attest to the direct connection between retroviral infections in felines and the appearance of hematopoietic tumors. In research conducted by Mello (2022), which retrospectively analyzed 1,470 necropsied cats, it was found that 26.9% had FeLV, 13.5% FIV, and 9.1% had co-infection. In FeLV-positive cats, neoplastic diseases were the main cause of death, corresponding to 47.22% of cases. In coinfected cats, this percentage reached 34.32%, and in isolated IVF-positive, 20.6%. In addition, it was found that those infected with FeLV have an almost four-fold higher risk of developing lymphomas and up to 19 times higher risk of leukaemia than non-infected individuals, results that are in line with traditional information in the international literature (Cotter, Hardy and Essex, 1975; Francis et al., 1977; Hardy, 1981; North and Banks, 2009).

There are also clinical cases that corroborate this relationship. According to the report by Lopes *et al.* (2025), a young cat, only one year and five months old, who was FeLV positive, developed multicenter immunophenotype b lymphoma. Confirmation of the diagnosis was made through aspiration cytology, histopathology and immunophenotyping by PCR-PARR. Although he was treated with the CHOP chemotherapy protocol, the patient had a rapid clinical progression and died after esophagostomy, evidencing the aggressive nature of the tumor in retrovirus-positive animals and the challenge in the clinical management of these patients.

Cunha (2018), similarly, described a case of food-borne lymphoma in an FIV-positive, FeLV-negative cat with an unfavorable clinical prognosis. Despite having been treated chemotherapeutic with the COP protocol, the animal only achieved a temporary remission, dying immediately after the second phase of maintenance. This case highlights the indirect effect of FIV on the propensity for hematopoietic tumors, even without the presence of FeLV, and the adverse therapeutic response in cats with immunosuppression (Dalek and Nardi, 2016; Hartmann, 2012b).

The chemotherapy protocols COP and CHOP are used in the treatment of retrovirus-positive feline lymphomas, with a mean survival generally less than nine months, significantly lower compared to uninfected cats (Hartmann, 2011). The

existence of retroviruses influences not only the prognosis of the neoplasm, but also predisposes animals to opportunistic infections, weight loss, cachexia, metabolic problems, and less resistance to chemotherapy (Mello, 2022). The connection between bacterial, viral, or parasitic coinfections and retrovirus, in addition to increasing morbidity, also increases the possibilities of early clinical decompensation (Mello, 2022).

FINAL CONSIDERATIONS

The review evidenced the correlation between FeLV and FIV infections and the development of hematopoietic neoplasms in felines. FeLV, with oncogenic action, and FIV, by immunosuppression, increase the predisposition to lymphomas and leukemias. FeLV-positive cats have a higher incidence of multicenter immunophenotype B lymphomas, while FIV increases the risk of foodborne lymphomas. Co-infection worsens the clinical condition and reduces survival. Advanced diagnostic methods, such as PCR-PARR and flow cytometry, are essential for staging and therapeutic direction. Chemotherapy protocols such as COP and CHOP provide temporary control, but survival rates are low in retroviral positive patients. The review highlights the importance of prevention and serological testing programs to reduce the prevalence of retroviruses and associated neoplasms.

REFERENCES

1. Bado, G. A. (2016). Linfoma em felinos: Abordagem diagnóstica e terapêutica. Clínica Veterinária, 21(122), 34–42.

2. Costa, F. V., & outros. (2017). Soroprevalência de FeLV e FIV em gatos domésticos em hospitais veterinários de Curitiba – PR. Archives of Veterinary Science, 22(3), 36–45. https://doi.org/10.5380/avs.v22i3.52491

3. Cunha, M. C. R. (2018). Linfoma alimentar em felino positivo para FIV: Relato de caso [Trabalho de Conclusão de Curso, Universidade Federal da Paraíba]. Repositório Institucional da UFPB.

4. Daleck, C. R., De Nardi, A. B., & Rodaski, S. (2008). Neoplasias em cães e gatos (1st ed.). Roca.

5. Dalek, M. C., & Nardi, A. B. (2016). Oncologia em cães e gatos (2nd ed.). Roca.

6. Feitosa, F. L. F., & outros. (2021). Prevalência de infecção por FeLV e FIV em gatos domésticos atendidos no hospital veterinário da Universidade Federal de Uberlândia. Ciência Animal Brasileira, 22(1), e55207. https://doi.org/10.1590/1809-6891v22e-55207

7. Fujino, Y., Ohno, K., & Tsujimoto, H. (2008). Molecular pathogenesis of feline leukemia virus-induced malignancies: Insertional mutagenesis. Veterinary Immunology and Immunopathology, 123(1–2), 138–143. https://doi.org/10.1016/j.vetimm.2008.01.019

8. Gabor, L. J., & outros. (2001). Feline leukaemia virus status of Australian cats with lymphosarcoma. Australian Veterinary Journal, 79(8), 540–545. https://doi.org/10.1111/j.1751-0813.2001.tb10753.x

9. Geine-Romanova, V., & Houtana, N. C. (2023). Hematopoietic neoplasms in domestic cats: A retrospective study. Veterinary Pathology, 60(1), 25–32. https://doi.org/10.1177/03009858221133567

10. Hartmann, K. (2011). Feline leukemia virus infection: Facts and myths. The Veterinary Clinics of North America: Small Animal Practice, 41(6), 1041–1058. https://doi.org/10.1016/j.cvsm.2011.08.005

11. Hartmann, K. (2012). Clinical aspects of feline retroviruses: A review. Viruses, 4(11), 2684–2710. https://doi.org/10.3390/v4112684

12. Horta, R. S., & outros. (2021). Diagnóstico e estadiamento dos linfomas em cães e gatos. Clínica Veterinária, (144), 20–28.

13. Jarrett, W. F. H., & outros. (1964). A virus-like particle associated with leukemia (lymphosarcoma). Nature, 202(4933), 567–569. https://doi.org/10.1038/202567a0

14. Levy, J. K., & outros. (2006). Seroprevalence of feline leukemia virus and feline immunodeficiency virus infection among cats in North America and risk factors for seropositivity. Journal of the American Veterinary Medical Association, 228(3), 371–376. https://doi.org/10.2460/javma.228.3.371

15. Lopes, M. M., & outros. (2025). Linfoma multicêntrico de imunofenótipo B em felino jovem doméstico FeLV positivo: Relato de caso. Scientific Electronic Archives, 18(1), 1–6.

16. Medeiros, S., & outros. (2012). Prevalência de retroviroses felinas em gatos domésticos de Natal, RN. Acta Veterinaria Brasilica, 6(3), 206–212.

17. Mello, M. F. (2022). Correlação entre infecção por FeLV e FIV e as causas de óbito em felinos domésticos necropsiados no município de Curitiba-PR (2010-2020) [Dissertação de mestrado, Universidade Federal do Paraná]. Repositório Digital da UFPR.

18. Nelson, R. W., & Couto, C. G. (2010). Medicina interna de pequenos animais (4th ed.). Elsevier.

19. North, S., & Banks, T. J. (2009). Oncology for veterinary technicians and nurses. Wiley-Blackwell.

20. Pedersen, N. C., & outros. (1987). Isolation of a T-lymphotropic virus from domestic cats with an immunodeficiency-like syndrome. Science, 235(4790), 790–793. https://doi.org/10.1126/science.3643650

21. Shelton, G. H., & outros. (1990). Lymphosarcoma associated with feline immunodeficiency virus infection in cats: 30 cases (1983–1988). Journal of the American Veterinary Medical Association, 196(10), 1616–1619.

22. Sunpongsri, T., & outros. (2022). Retrospective study of feline lymphoma: Association with FeLV and FIV. Veterinary Medicine and Science, 8(1), 240–250. https://doi.org/10.1002/vms3.666