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Evaluation of PT, APTT, Fibrinogen, CBC-Derived Inflammation Indices (NLR, MLR, EOLR, PLR) and Clinical Findings in FIV-Infected Cats

Zeynep Nurselin Kot[1,a*], Umit Ozcan[1,b]

[1]*Ondokuz Mayıs University, Faculty of Veterinary Medicine, Department of Veterinary Internal Medicine, 55200, Samsun, Türkiye*
[*]*Corresponding author*

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ABSTRACT

Feline immunodeficiency virus (FIV) is a chronic infectious retrovirus that causes immune dysfunction and multisystemic clinical manifestations in cats. This study evaluates the correlations between clinical, hematological, biochemical, and ultrasonographic findings, including coagulation parameters and CBC-derived indices, in PCR-confirmed FIV-infected cats (n=10). Following detailed physical examinations at a Veterinary Faculty Animal Hospital, whole blood and saliva swab samples were collected for PCR testing and comprehensive diagnostic workup, with results correlated to clinical observations. Following detailed physical examinations at Veterinary Faculty Animal Hospital, whole blood and saliva swab samples were collected for PCR testing and comprehensive diagnostic workup, with results correlated to clinical observations. Gingivitis (100%) was the most common clinical finding in all cases, while vomiting (60%), dermatological lesions (40%), stomatitis (20%), and weight loss (20%) were detected at varying rates. Hematological results revealed a high incidence of thrombocytopenia and low erythrocyte index values in all cats. Elevated urea levels in biochemical assessments, along with low albumin and an albumin-globulin ratio, indicate hyperproteinemia, which suggests renal and inflammatory processes in a significant proportion of cases. Prothrombin time (PT) was prolonged in some cats (50%), but fibrinogen and activated partial thromboplastin time (APTT) remained within the reference range throughout. CBC-derived indices were: neutrophil/lymphocyte ratio (NLR) mean 2.85±2.29, monocyte/lymphocyte ratio (MLR) averaged 0.09±0.11, platelet/lymphocyte ratio (PLR) averaged 98.45±72.89, and eosinophil/lymphocyte ratio (EOLR) averaged 0.23±0.12. Ultrasonographic examination supported the renal volume changes and medullary rim sign findings reported in the literature. The findings suggest that the infection can have significant systemic effects, even in young cats with no exposure to the outside world. In conclusion, the study highlights the importance of considering FIV infection in the presence of risk factors and laboratory abnormalities, as well as the importance of regular retroviral screening and monitoring of organ function and coagulation parameters.

[a] *znurselin.kot@omu.edu.tr* *https://orcid.org/0000-0002-0631-5471* | [b] *umit.ozcan@omu.edu.tr* *https://orcid.org/0000-0002-0868-6399*

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Introduction

Feline immunodeficiency virus (FIV) is an enveloped RNA virus belonging to the Lentivirus genus of the Retroviridae family. It exhibits biological and pathological similarities to Human immunodeficiency virus (HIV), and is therefore used as an important animal model for HIV infection and AIDS research (Nehring et al., 2024; Sykes, 2013).

Clinical signs in cats infected with FIV are generally non-specific (Gleich & Hartmann, 2009). Prone to chronic and recurrent infections (clinical phase), non-specific disease signs, lymphoma, myelosuppression, neurological disease, and chronic inflammatory diseases are frequently observed (Battilani et al., 2022). Common clinical findings in symptomatic cats include gingivostomatitis (often resistant to treatment and severe), oral resorptive lesions, fever, weight loss, and symptoms of upper respiratory tract infection (Bezerra et al., 2024; Westman et al., 2022).

Common hematological abnormalities in FIV-positive cats include mild anemia, lymphopenia, and neutropenia. However, some studies have found hemoglobin, hematocrit, and erythrocyte values to be negative or significantly lower than in healthy cats (Battilani et al., 2022; Gleich et al., 2009). The most common and significant abnormality in biochemical parameters is hyperproteinemia, which is typically caused by an increase in γ-globulin. Polyclonal B-cell activation in FIV-infected cats reflects hypergammaglobulinemia (Gleich & Hartmann, 2009). In FIV-infected cats, serum protein

concentration is also high, and the albumin/globulin (A/G) ratio is lower. Clinical signs of azotemia are observed in infected cats (Battilani et al., 2022; Rudan et al., 2017).

As FIV is a chronic and progressive disease, it can lead to secondary diseases and neoplasms affecting various organ systems in the body. Changes in these organ systems can be detected using imaging techniques such as ultrasonography (Chandler et al., 2019). Neoplasms are particularly associated with lymphoma in cats infected with FIV and are commonly seen. Lymphoma findings may appear in the gastrointestinal system, mediastinum, or kidneys (de Mello et al., 2025). Widespread peripheral lymphadenopathy may be observed in the acute phase and advanced stages of infection (Pedersen et al., 1989). Abdominal ultrasound revealed hepatomegaly, patchy hypoechoic areas in the spleen, mild enlargement of ileocecal lymph nodes, and mild diffuse thickening of the small bowel submucosa (Sykes, 2013). These findings reflect chronic inflammatory processes and organ involvement associated with FIV.

Inflammation markers obtained from the haemogram, including neutrophil/lymphocyte ratio (NLR), monocyte/lymphocyte ratio (MLR), and platelet/lymphocyte ratio (PLR), are new, widely used, inexpensive, and readily accessible systemic inflammation markers derived from routine haemogram examinations. Recently, these parameters have been evaluated in feline inflammatory (Gori et al., 2021) and neoplastic (Chiti et al., 2021) diseases, have been proposed as diagnostic and prognostic markers for some inflammatory and neoplastic diseases (Pierini et al., 2020).

Thrombocytopenia, prolonged prothrombin time (PT), activated partial thromboplastin time APTT, and elevated D-dimer levels are frequently observed findings in HIV-positive patients (Getawa & Adane, 2022). In FIV seropositive cats, mild prolongation of APTT, PT, and fibrinogen concentration has been reported, but PT and platelet function are generally normal (Deniz, 1999; Hart & Nolte, 1994; Sykes, 2013).

The aim of the study is to evaluate the clinical findings observed in FIV-positive cats using PCR and enzyme-linked immunosorbent assay (ELISA) methods, along with hematological, serum biochemical, CBC-derived inflammation indices (NLR, MLR, PLR, EOLR), and ultrasonographic findings, as well as APTT, PT, and fibrinogen values.

Materials and Methods

Studied Animals

The study consists of 10 cats of different ages, genders, and breeds that were brought to the Ondokuz Mayıs University Faculty of Veterinary Medicine Animal Hospital with complaints of vomiting, loss of appetite, lethargy, or gingivitis, and were found to be FIV PCR positive as a result of the tests performed. The presence of findings such as gingivitis, stomatitis, tongue lesions, dermatological lesions, pruritus, fever, anemia, lymph node examination, weight loss, loss of appetite, vomiting, and nasal discharge was recorded using the form created during the detailed physical and clinical examinations of the cats.

Hematological and Biochemical Tests

A total of 2 ml of blood sample was collected from the antebrachial cephalic vein into an EDTA-containing tube and an empty tube using techniques suitable for cats for hemogram count and serum biochemical analyses. A complete blood count (CBC) was performed using a laser and fluorescence-based, fully automated hematology analyzer (BC60R VET, Mindray, China). In complete blood analyses, WBC ($x10^3$/mcL), Neu ($x10^3$/mcL), Lym ($x10^3$/mcL), Mon ($x10^3$/mcL), Eos ($x10^3$/mcL), RBC ($x10^6$/mcL), HGB (g/dl), HCT (%), MCV (fL), MCHC (g/dl), PLT ($x10^3$/mcL), and MPV (fL) parameters were evaluated. Based on these parameters, the neutrophil/lymphocyte ratio (NLR), monocyte/lymphocyte ratio (MLR), eosinophil/lymphocyte ratio (EOLR), and platelet/lymphocyte ratio (PLR) inflammatory indices were determined. Serum biochemistry was performed using a fully automated analyzer (RX Monaco, Randox Laboratories, United Kingdom and IDEXX Catalyst One, IDEXX Laboratories Inc., Westbrook, ME, USA). For this purpose, the patient's BUN, creatinine, total cholesterol, triglycerides, albumin, globulin, total protein, ALT, ALP, glucose and albumin/globulin values were determined.

Point-of-care (PoC) FIV Testing

Enzyme-linked immunosorbent assay (ELISA) Anigen Rapid™ FIV Ab/FeLV Ag rapid tests were performed on whole blood samples taken from cats. For this purpose, 10 µl of whole blood from an EDTA-containing tube at room temperature was dispensed into the sample compartment using a capillary tube, followed by the addition of diluent buffer to the same compartment. The same procedure was applied to the FeLV sample compartment. After waiting for 10 minutes, the results were evaluated according to the procedures.

FIV PCR Testing Using Blood and Saliva

Whole blood and oral saliva swabs (Westman et al., 2019) collected from cats suspected of being infected with FIV for hematological analysis were sent to a routine virology laboratory. FIV RealPCR™ assay using saliva and whole blood testing. Cats that tested FIV PCR positive based on the test results were included in the study.

APTT, PT and Fibrinogen Analyses

Blood samples (1 ml) were collected directly from the vena cephalica antebrachi of cats using an 18-gauge, heparin-free needle into vacutainer tubes containing 3.18% trisodium citrate anticoagulant. Analyses were performed using APTT, PT, and fibrinogen reagent kits with the Healvet COA7000 coagulation analyzer.

Ultrasonographic Examination

Detailed abdominal ultrasonographic examinations of the cats included in the study were performed by a single user using the ESAOTE MyLab-5 ultrasound device. The spleen, liver, right and left kidneys, and lymph nodes were assessed for size and echogenicity during the examination.

Statistical Analyses

The descriptive statistics of the study were determined using IBM SPSS v.21 software and presented in Tables 2 and 3. Hematological, biochemical and coagulation values were presented as Mean±Standard deviation (95% Confidence Interval).

Results

The study population had an average age of 27.60±11.69 months (min 18, max 48) and consisted of cats of different breeds and genders (4 males and 6 females), 10 neutered/spayed cats, and cats with no contact with the outside world (Figure 1).

Clinical findings in cats: gingivitis 10/10 (100%), stomatitis 2/10 (20%), lesions on the tongue 3/10 (30%), dermatological lesions 4/10 (40%), pruritus 1/10 (10%), hyperthermia 0/10, anemia 1/10 (10%), lymph nodes 2/10 (20%), weight loss 4/10 (40%), anorexia 5/10 (50%), vomiting 6/10 (60%), rhinitis 2/10 (20%) were found (Table 1).

When examining the hematological data of cats, WBC (5.5-19.5 x10³/mcL), neutrophils (2.5-12.5 x10³/mcL), eosinophils (0-0.8 x10³/mcL) and HGB (9.8-15.4 g/dl) were higher than the reference value in one out of ten cats, while RBC was higher than the reference values (5.0-10.0 x10⁶/mcL) in five out of ten cats. MCHC was found to be lower than the reference values (30–36 g/dl) in all 10 cats, and PLT was found to be lower than the reference value (300–800 ×10³/mcL) in 7 out of 10 cats (Table 2).

The mean NLR was 2.85±2.29, the mean MLR was 0.09±0.11, the mean EOLR was 0.23±0.12, and the mean PLR was 98.45±72.89 in the cats included in the study. In serum biochemical analyses, the mean BUN value was higher than the reference value (19-34 mg/dl) in 9 out of 10 cats, creatinine in 2/10 (0.8-1.8 mg/dl), TP in 6/10 (5.4-7.5 mg/dl), ALP in 4/10 (0-45 U/L), and glucose in 1/10 (60-120 mg/dl) were higher than the reference range. The albumin value was below the reference range in 8/10 (2.8-3.9 mg/dl), and the A/G ratio was below 0.8 in 10/10.

The APTT, PT, and fibrinogen levels of FIV-infected cats included in the study are as indicated in Table 4. When examining the clotting factors of the cats included in the study in relation to fibrinogen values (1-3g/L) only 1 out of 10 cats had a value higher than the reference value, 5 out of 10 cats had a PT value (5-15 sec) higher than the reference value, and all cats included in the study had an APTT value (15-45 sec) within the reference range.

Detailed abdominal ultrasonography was performed on all cats included in the study by a single practitioner. The ultrasonographic examination assessed the presence of any pathology, including hypertrophic, atrophic, and echogenic changes in the liver, spleen, kidneys, and lymph nodes in the abdomen. Accordingly, no pathology was encountered in the liver, spleen, or abdominal lymph nodes of the cats included in the population, while the pathological changes encountered in relation to the kidneys are shown in Table 5. The results showed that 2/10 cats had medullary rim signs in the right and left kidneys, 2/10 cats had bilateral renal atrophy, and 2/10 cats had bilateral renal hypertrophy (Figure 2). According to the current literature, small kidneys are defined as < 3.2 cm, while enlarged kidneys are defined as > 4.4 cm (Widmer et al., 2004).

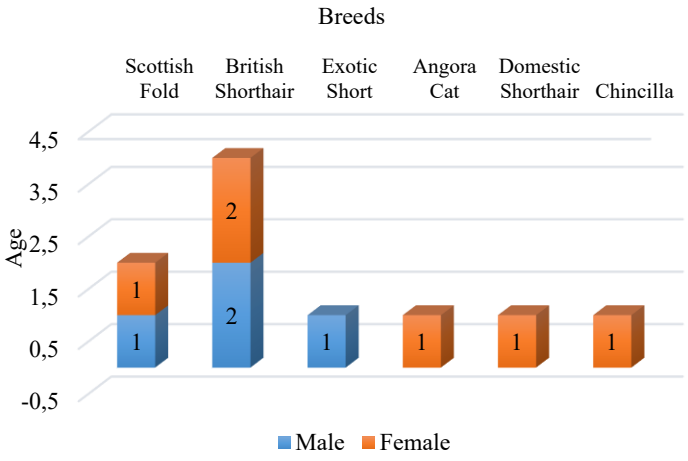

Figure 1. Age, sex and breed distribution of the cats comprising the study population.

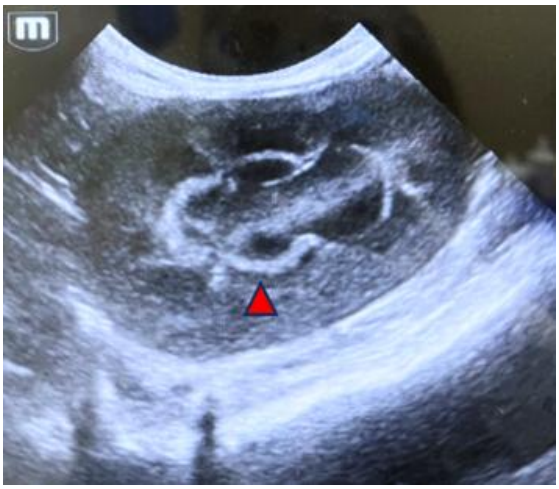

Figure 2. Transabdominal ultrasound image showing the peripheral margin surrounding the lesion in with FIV-infected cat, (rim sign, arrowhead).

Table 1. Clinical signs in FIV-infected cats (%).

Symptoms	Positive %	Negative %
Gingivitis	100	0
Stomatitis	20	80
Oral Lesion	30	70
Dermatological lesions	40	60
Pruritis	10	90
Fever	0	100
Anemia	10	90
Weight Loss	20	80
Lethargy	40	60
Vomit	60	40
Rhinitis	20	80

Table 2. Descriptive statistics of the hematological data of FIV-infected cats.

	Refence	Mean±SD	95% CI:
WBC $\times 10^3$/mcL	5.5 – 19.5	12.56±7.10	3.74 – 21.38
Neu $\times 10^3$/mcL	2.5 – 12.5	8.51±6.60	0.31 – 16.70
Lym $\times 10^3$/mcL	1.5 – 7.0	3.06±0.54	2.38 – 3.11
Mon $\times 10^3$/mcL	0 – 0.9	0.27±0.33	0.14 – 0.69
Eos $\times 10^3$/mcL	0 – 0.8	0.71±0.37	0.24 – 1.17
RBC $\times 10^6$/mcL	5.0 – 10.0	8.65±2.80	5.16 – 12.14
HGB g/dl	9.8 – 15.4	12.64±3.68	8.07 – 17.20
HCT %	30 – 45	0.33±0.09	0.21 – 0.44
MCV fL	38 – 55	38.78±3.76	34.10 – 39.00
MCHC g/dl	30 – 36	14.66±1.08	13.30 – 16.01
PLT $\times 10^3$/mcL	300 – 800	302.60±231.37	15.30 – 589.89
MPV fL	12 – 18	12.20±1.29	10.59 – 13.80

Table 3. Descriptive statistics of serum biochemical parameters in FIV-infected cats.

	Refence	Mean±SD	95% CI:
BUN	19 – 34 mg/dl	40.66±14.03	23.23 – 58.08
Creatinine	0.8–1.8 mg/dl	1.27±0.43	0.74 – 1.81
Phosphorus	3.0 – 6.1 mg/dl	5.22±0.55	4.53 – 5.91
TCHOL	71 – 156 mg/dl	130.40±17.78	108.31 – 152.48
TG	24 – 115 mg/dl	47.48±22.30	19.78 – 75.18
ALB	2.8 – 3.9 mg/dl	2.54±0.24	2.24 – 2.83
TP	5.4 – 7.5 mg/dl	7.66±0.84	6.61 – 8.70
A/G ratio	< 0.8	0.51±0.10	–
ALT	25 – 97 U/L	38.80±16.37	18.46 – 59.13
ALP	0 – 45 U/L	32.96±15.42	13.80 – 52.11
Glucose	60 – 120 mg/dl	100.66±17.43	79.01 – 122.30

Table 4. Descriptive statistics for fibrinogen, PT, and APTT values in FIV-infected cats included in the study.

	Refence	Mean±SD	95% CI:
Fibrinogen	1 – 3g/L	3.03±2.45	1.28 – 4.79
PT	5 – 15 sec	27.82±32.89	4.28 – 51.35
APTT	15 – 45 sec	19.98±6.74	15.15 – 24.80

Table 5. Ultrasonographic evaluation of renal pathologies in FIV-infected cats.

No	Medullar rim sign	Right kidney (3.2–4.4cm)	Left kidney (3.2–4.4cm)
1	–	Normal	Normal
2	–	< 3.2cm	< 3.2cm
3	+	Normal	Normal
4	–	4.4cm >	4.4cm >
5	–	Normal	Normal
6	–	4.4cm >	4.4cm >
7	–	Normal	Normal
8	+	< 3.2cm	< 3.2cm
9	–	Normal	Normal
10	–	Normal	Normal

Discussion

The aim of this study is to evaluate the hematological, serum biochemical, and coagulation parameters (APTT, PT, fibrinogen) of FIV-infected cats, assess CBD-derived inflammation indices (NLR, MLR, PLR, EOLR), and evaluate the reflections of these findings on clinical and ultrasonographic findings, comparing them with existing data in the literature. Due to the slow progression of FIV infection, most data in the literature regarding clinical-pathological changes have been obtained from FIV seropositive (Ab positive) cats in the asymptomatic or chronic clinical stage of infection (Aksoy, 2025; Battilani et al., 2022; Bezerra et al., 2024; Deniz, 1999; Gleich & Hartmann, 2009; Hart & Nolte, 1994; Rossi et al., 2024; Rudan et al., 2017). Since retroviruses can show intermittent viremia, tests that detect both anti-FIV antibodies and FIV antigens or nucleic acids should be used together for the diagnostic procedure (Little et al., 2020). However, some more recent FIV prevalence studies have reported PCR as an effective diagnostic technique (Gates et al., 2017; Muz et al., 2021).

In the study, serological and PCR diagnostic methods were used together. In one study, the prevalence of FIV was found to be 5.5% with the POC test and 5.7% with PCR, which are similar rates. In contrast, in the present

study, all 10 cats that were PCR positive were found to be FIV Ab negative. These results differ from those of recent studies (Bezerra et al., 2024; Nehring et al., 2024).

Regarding risk factors, cats having access to the outdoors has often been associated with FIV infection. Reports indicate that cats with this lifestyle are four times more likely to be FIV positive (Burling et al., 2017; Szilasi et al., 2019; Szilasi et al., 2021) Although bites are mostly reported to originate from territorial fights between unneutered male cats, in the present study, 6 out of 10 FIV-infected cats were female (60%) and 4 were male (40%), all of which were neutered/spayed and had no contact with the outdoors, therefore no relationship between gender and reproductive status could be established. One study reported that 1049/1834 (57.2%) of FIV-infected cats were male, 610/1049 (58.2%) of which were neutered, and 778/1834 (42.2%) were female, 488/788 (61.9%) of which were spayed (Battilani et al., 2022). In a different study, 19 (73.1%) of 26 FIV-positive cats were male, 7 (26.9%) were female, 20 (76.9%) were neutered, 6 were unneutered (23.1%), and 22 (85%) had contact with the outside (de Mello et al., 2025). In contrast, other studies have reported no association between the severity of clinical symptoms and the age or sex of the animals (Rudan et al., 2017). These reported results contradict other literature indicating that unneutered, outdoor male cats have a high probability of contracting FIV infection (Gleich et al., 2009; Kokkinaki et al., 2021; Norris et al., 2007).

Research shows that the likelihood of FIV positivity in cats increases proportionally with age, and that this risk is particularly high in cats over 5 years old (Luckman & Gates, 2017). In different studies, the average age of FIV-infected cats is 4.5 years (Kokkinaki et al., 2021) to 9 years (Battilani et al., 2022). A study conducted in Brazil found that 73.1% of FIV-positive cats were over 5 years old, with an average age of 7 (de Mello et al., 2025). According to a study conducted in Croatia, 60% of FIV-positive cats are reported to be between 7 and 10 years old (Rudan et al., 2017). The average age of the cats included in the current study was determined to be a minimum of 18 months and a maximum of 48 months (average 27.60±11.69). The fact that the average age is quite low compared to the literature reflects the high incidence of pathological changes seen in this young population and the severe clinical-pathological effects of retroviral infection.

The most common clinical signs of FIV include lethargy, fever, loss of appetite, diarrhea, stomatitis, gingivitis, dermatological lesions and/or itching, weight loss and/or lymphadenopathy (Kokkinaki et al., 2021; Sykes, 2013). In a different study, respiratory diseases/symptoms were present but not statistically significant (de Mello et al., 2025). Consistent with the literature, the findings of this study reveal that the most common clinical findings are gingivitis (100%), followed by vomiting (60%), lethargy (40%), dermatological lesions (40%), and rhinitis (20%).

Hematological analyses of the cats in the study revealed significant abnormalities in platelet (PLT) counts, with 7 out of 10 cats (70%) having PLT counts below reference values (Table 2). In the symptomatic phase of FIV, anemia, leukopenia, hyperglobulinemia, and azotemia have been reported among hematological and biochemical abnormalities (Battilani et al., 2022). Furthermore, various studies have also encountered anemia, neutropenia, leukopenia, and thrombocytopenia in the hematological findings of FIV-infected cats (Fujino et al., 2009; Gleich & Hartmann, 2009). Although thrombocytopenia is known to be a common finding in cats infected with FeLV (Stutzer et al., 2010), some studies have reported thrombocytopenia in 10-11% of FIV-positive cats. Thrombocytopenia observed in FIV-infected cats is associated with bone marrow suppression or the destruction of platelets in the peripheral blood (Shelton et al., 1990).

The mean corpuscular hemoglobin concentration (MCHC) value was found to be below reference values in all 10 cats (100%), which is an important finding from the study. Anemia (low RBC, HBG, HCT) is a common condition in the course of FIV infection (de Mello et al., 2025), but some studies have reported that the risk of anemia in FIV-positive cats is lower than in control groups or that hematological abnormalities are not as common as in FIV-positive cats. Rudan et al. (2017) noted in their study that MCHC tended to decrease in FIV-infected cats (Rudan et al., 2017). Anemia may be non-regenerative in nature due to myelodysplastic syndrome or chronic disease anemia (de Mello et al., 2025; Gleich & Hartmann, 2009).

Rudan et al. (2017) found that HBG, HCT, and RBC values were lower in FIV-positive cats compared to those in negative and healthy cats (Rudan et al., 2017). Similarly, a study analyzing hematological parameters showed that FIV-positive cats exhibited lower values for RBC, hemoglobin, hematocrit, lymphocytes, and platelets compared to negative animals (Bezerra et al., 2024). In contrast, 5 out of 10 cats in the population had RBC values higher than the reference range, while HBG and HCT values remained unchanged. This contradicts the anemia typically associated with FIV infection (Deniz, 2001; Fujino et al., 2009; Gleich & Hartmann, 2009). Neutrophil apoptosis is reported to be among the most common causes of neutropenia in cats infected with FIV (Gleich & Hartmann, 2009; Shelton et al., 1990). Current study findings contradict the literature, indicating that WBC, neutrophil, and eosinophil levels are elevated in one out of ten cats; A study by Rudan et al. (2017) reported that segmented and non-segmented neutrophils increased in cats coinfected with FIV or FeLV, and that the finding of leukocytosis was more pronounced in cats infected with FIV (Rudan et al., 2017). However, a study states that there is no significant difference in the total leukocyte count between the groups (Gleich & Hartmann, 2009).

Aydın (2025) evaluated NLR, MLR, and PLR in cats infected with feline panleukopenia virus (FPV) and found a statistically significant difference between the median PLR value of healthy control cats (75.78) and the median PLR value of cats with FPV (174.43) ($p<0.001$) (Aydın, 2025). The median NLR and MLR values of FIV seropositive cats were found to be significantly higher than those of the healthy group; however, PLR values did not show a significant difference among the three groups (Aksoy, 2025). In a study conducted by Rossi et al. (2024), the median values in FIV seropositive cats were found to be NLR 1.71 (min 0.12: max 46.99), MLR 0.04 (min 0: max 2), and PLR 68.25 (min 4.13: max 665.80) in FIV seropositive cats, and no statistical significance was found compared to FIV seronegative cats. In the same study, the median NLR value for FIV-seropositive and surviving cats was 1.70, whereas the median NLR value for non-

surviving cats was 2.86 (p = 0.09). The MLR value was 0.05 in surviving cats and 0.11 in non-surviving cats (p=0.05), while the PLR value was 77.33 in surviving cats and 86.30 in non-surviving cats (p=0.73). Consequently, it was concluded that this increase in NLR and MLR would result in a poor prognosis in FIV-positive cats. In the present study, the NLR value (2.85±2.29), MLR (0.09±0.11), and PLR value (98.45±72.89) were found to be consistent with the data in the literature (Rossi et al., 2024). Furthermore, the data obtained on the EOLR value (0.23 ± 0.12) in FIV PCR-positive cats in this study are significant in terms of current research.

Biochemical findings suggest widespread systemic responses and organ dysfunction in this population. Hyperglobulinemia is a classic finding in FIV (Gleich & Hartmann, 2009; Miro et al., 2007; Shelton et al., 1995). This condition is explained by polyclonal B-cell activation and a high gamma-globulin fraction developing in response to chronic and persistent infection (Battilani et al., 2022). A study conducted by Battilani et al. (2022) showed that cats in the FIV-positive group were more likely to have hyperproteinemia (34%), hypoalbuminemia (34%), and a decrease in the albumin-globulin ratio (46%) compared to other groups (Battilani et al., 2022). In this context, the fact that the A/G ratio was below 0.8 in all 10 cats and albumin levels were low in 8/10 cats, along with the presence of hyperglobulinemia and hypoalbuminemia, confirms the correlation between FIV and hyperglobulinemia; this correlation is generally due to an excessive natural immune response to chronic infection (Miro et al., 2007; Shelton et al., 1995). The TP value obtained in the study findings, which is higher than the reference value in 6/10 cats, is consistent with hyperglobulinemia (Bezerra et al., 2024; Gleich & Hartmann, 2009).

Azotemia and elevated creatinine levels are clinical-pathological abnormalities reported in the symptomatic stages of FIV. It has been reported that 13.5% of FIV-positive cats have elevated urea and creatinine levels, indicating kidney failure (Deniz, 2001). The 90% elevation in BUN observed in this study highlights the prevalence of serious renal problems even in this young population. On the other hand, Thomas et al. (1993) reported a lower incidence (4.9%) of urinary tract disease in FIV-positive cats (Thomas et al., 1993). Gleich and Hartmann (2009) found that creatinine levels were low in FeLV-infected cats; however, this finding did not affect FIV-positive cats (Gleich & Hartmann, 2009). In a study conducted by Battilani et al. (2022), it was found that there was no difference in creatinine levels between FIV-positive cats; however, BUN levels were higher than those in the healthy group (Battilani et al., 2022). Bezerra et al. (2024) found that BUN and creatinine were elevated in FIV-infected cats compared to negative animals (Bezerra et al., 2024). The 90% prevalence of elevated BUN observed in this study highlights the prevalence of serious renal problems even in this young population.

Hepatopathy and elevated liver enzymes (ALT, GLDH) may be observed in the course of FIV infection (Deniz, 2001); conversely, AST and glutamate dehydrogenase (GLDH) have been reported to be lower in FIV-positive cats than in FIV-negative cats (Gleich & Hartmann, 2009). In a recent study, it was reported that ALP levels were lower in FIV-positive cats compared to other groups (Battilani et al., 2022). The increase in ALP observed in the current study results contradicts the reported data. While total cholesterol and triglycerides have been reported to be elevated in FIV-positive cats with liver disease (Kokkinaki et al., 2021), no significant change in these two values was observed in the present study.

In FIV-positive cats, the PT is usually within the normal range because there is generally no abnormality in the exogenous coagulation pathway (Deniz, 1999; Hart & Nolte, 1994). Some studies have found pathologically prolonged APTT in 55% and 28.6% of FIV-infected cats, respectively. This prolongation indicates a defect in the endogenous coagulation system. Fibrinogen concentration is frequently elevated in FIV infection. One study found fibrinogen concentrations to be higher than normal in 67.5% of FIV-positive cats, while another study found this to be the case in 54.05% (Hart & Nolte, 1994; Sykes, 2013). In meta-analysis comparisons between HIV-infected patients and HIV seronegative controls, PT levels were found to be significantly higher (SMD = 0.66; 95% CI: 0.53–0.80 and SMD = 1.13; 95% CI: 0.60–2.0, respectively). However, APTT and fibrinogen levels were found to be significantly higher in seronegative controls compared to HIV-infected patients receiving highly active antiretroviral therapy (Getawa & Adane, 2022). In the present study, elevated fibrinogen in 1 FIV-infected cat and elevated PT in 5 cats are consistent with existing studies. However, the normal APTT in all cats may be related to the infectious periods of the cats in the population. More current studies in this area are needed to clarify this situation. It is known that HIV-infected patients are more likely to develop coagulation abnormalities than HIV seronegative controls. Therefore, regular assessment of coagulation parameters is crucial for preventing and monitoring coagulation disorders in FIV-infected cats.

In a study evaluating 91 cats infected with FIV, ultrasonographic examination revealed a medullary rim sign in 8.8% of cases, renal size exceeding 4.4 cm or greater (renomegaly), and 6.6% had a kidney size of less than 3.2 cm (renal atrophy) (Taffin et al., 2017). In the present study, medullary rim sign (2/10), bilateral renomegaly (2/10), and bilateral renal atrophy (2/10) findings were identified.

The study findings should be interpreted with caution in terms of generalizability due to the limited sample size. As the different clinical stages of FIV infection were not classified in detail in this study, the relationship between the parameters evaluated and the stage of the disease could not be clearly assessed. Finally, the absence of a control group in the study can be cited as another limiting factor in comparing the parameters to healthy references.

Conclusion

The study demonstrates that even in young, FIV PCR-positive cats with no contact with the outside world, significant hematological, biochemical, and renal changes, along with frequent clinical findings in the gingiva and gastrointestinal tract, may be observed. High rates of thrombocytopenia, low albumin–globulin ratio, and increased BUN levels are noteworthy as early indicators of systemic involvement. Furthermore, prolonged PT in some cases indicates potential hemostatic disorders. CBC-

derived inflammation indices (NLR, MLR, PLR) were found to be consistent with current studies, and new data on the EOLR value in FIV-PCR-positive cats were obtained. The findings emphasize the importance of considering FIV infection in the presence of a wide range of risk factors and laboratory abnormalities, as well as the importance of regular retroviral screening and monitoring of organ function and coagulation parameters. Larger, controlled studies are necessary to clarify differences based on disease stages and to strengthen clinical management approaches.

Declarations

Ethical Approval Certificate

Informed consent forms were obtained from the patients included in the study.

Author Contribution Statement

Zeynep Nurselin Kot: Data collection, conceptualization, investigation, formal analysis, and writing the original draft.

Umit Ozcan: Supervision, conceptualization, data collection, investigation, methodology, review and editing.

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Conflict of Interest

The authors declare no conflict of interest.

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