

Hematological and biochemical parameters of cats with FeLV infection

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ABSTRACT – *Feline leukemia virus (FeLV) can cause the alteration of the hematological and biochemical parameters. This retrospective study aimed to determine the alteration of the hematological and biochemical parameters of client-owned cats with FeLV infection. Anemia, decreased segmented neutrophils with concurrently increased lymphocytes and eosinophils levels were the most frequent hematological abnormalities in FeLV+ cats. Hyperproteinemia was the most frequent the alteration of the biochemical parameters in FeLV+ cats. These results suggest that hematological and biochemical parameters are useful diagnostic tools for diagnosis of FeLV infection. However, this study is underpowered for statistical analyses. Therefore, further research using a larger FeLV+ cat population is required.*

Keywords—Complete blood count, serum biochemistry, feline leukemia virus, cat

1. INTRODUCTION

Feline leukemia virus (FeLV) can cause the alteration of the hematological and biochemical parameters (Gleich & Hartmann, 2009). Hematological and biochemical parameters are useful diagnostic tools for diagnosing and monitoring the progression of FeLV infection (Hofmann-Lehmann *et al.*, 1997; Gleich & Hartmann, 2009). The aim of this retrospective study was to determine the alteration of the hematological and biochemical parameters of client-owned cats with FeLV infection.

2. MATERIALS AND METHODS

2.1. Animals

This study enrolled 7 FeLV+ cats that were included in an epidemiological study (Raukar, 2021), in which the prevalence of FeLV was determined. Blood sampling and methods for the detection of FeLV infection have been described in this epidemiological study (Raukar, 2021), but the laboratory results of hematological and biochemical analysis were not presented in this previous study. Therefore, laboratory results of complete blood count (CBC), total protein, albumin, globulin, albumin/globulin ratio (A/G ratio), urea, creatinine, aspartate transaminase (AST) and total bilirubin of FeLV+ cats are described in the current study.

2.2. Ethical consideration

Ethical approval was not required for this study (Ministry of Agriculture of the Republic of Croatia, Reference numbers: 525-6-08-3 BBŠ; 525-6-08-5 BBŠ).

2.3. Sampling

From each of the 7 individual FeLV+ client-owned cats, 0.5 ml of whole venous blood was aseptically sampled for biochemical analysis into tubes that did not contain anticoagulants. The blood samples were left for 30 min standing at room temperature to allow the blood to clot. After 30 min, serum was obtained by centrifugation at 4,500 rpm for 5 min. Then the serum was pipetted into another tube, and the samples were stored at –20°C.

From each of the 7 individual FeLV+ client-owned cats, blood smears of peripheral blood were prepared for the determination of leukogram. Samples were transported on dry ice and blood smears within 48 h after collection to the Faculty of Veterinary Medicine, Vienna, Austria, where biochemical tests and differential blood count were conducted in the Clinical Pathology Platform. In serum biochemistry albumin, globulin and A/G ratio were not determined for one FeLV+ cat. From each of the 6 individual FeLV+ client-owned cats, 0.5 ml of whole venous blood was aseptically sampled for hematological tests into tubes with EDTA (ethylenediaminetetraacetic acid). Total erythrocyte count (TRBC), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), hematocrit (HCT)/packed cell volume (PCV), hemoglobin (Hb), total leukocyte count (TWBC) and platelet (PLT) (thrombocyte) count were analyzed immediately after sample collection in veterinary clinic for small animals “Dr. Pezo” in Zagreb, Croatia.

2.4. Hematology

2.5. Total erythrocyte count, MCV, MCH, MCHC, hematocrit, hemoglobin, total leukocyte count and platelet (thrombocyte) count

Total erythrocyte count, MCV, MCH, MCHC, hematocrit, hemoglobin, total leukocyte count and platelet count were determined using an automated hematology analyzer Beckman Coulter.

2.6. Differential blood count

The differential blood count was determined manually microscopically from Romanowsky (Haemaquick[®], Biomed, Oberschleißheim Germany) stained blood smears.

2.7. Serum biochemistry

2.8. Total protein

Total protein content was measured using a fully selective autoanalyzer (Hitachi 911[®]; Roche Diagnostics, Vienna) using the colorimetric biuret method.

2.9. Albumin

Albumin was measured using a fully selective autoanalyzer (Hitachi 911[®]; Roche Diagnostics, Vienna) using Bromcresol Green method.

2.10. Globulin

Globulin concentration was calculated using formula: Total protein (g/dl) - Albumin (g/dl).

2.11. Albumin/globulin ratio

The ratio albumin/globulin was calculated using formula A/G ratio=albumin/globulin.

2.12. Urea

Urea was measured using a fully selective autoanalyzer (Hitachi 911[®]; Roche Diagnostics, Vienna) using enzymatic-kinetic UV-test.

2.13. Creatinine

Creatinine was measured using a fully selective autoanalyzer (Hitachi 911[®]; Roche Diagnostics, Vienna) using enzymatic color test.

2.14. Aspartate transaminase (AST)

Aspartate aminotransferase (AST) was measured using a fully selective autoanalyzer (Hitachi 911[®]; Roche Diagnostics, Vienna) using International Federation of Clinical Chemistry (IFCC) method.

2.15. Total bilirubin

Total bilirubin was measured using a fully selective autoanalyzer (Hitachi 911[®]; Roche Diagnostics, Vienna) using chromogenic test.

The reference ranges were: erythrocyte count ($5.50-10.00 \times 10^{12}/L$), hemoglobin concentration (100.0-150.0 g/L), hematocrit (30.0-45.0%), MCV (37.0-49.0 fL), MCH (13.0-17.0 pg), MCHC (320.0-380.0 g/L), leukocyte count ($5.5-19.5 \times 10^9/L$), platelet (thrombocyte) count ($300.0-700.0 \times 10^9/L$), non-segmented neutrophils (< 4.0%), segmented neutrophils (60.0-75.0%), lymphocytes (15.0-30.0%), monocytes (< 5.0%), eosinophils (< 4.0%), basophils (< 1.0%), total protein (6.00-7.50 g/dl), albumin (2.8-3.9 g/dl), globulin (2.6-5.1 g/dl), A/G ratio (0.45-1.19), urea (20.0-65.0 mg/dl), creatinine (< 1.60 mg/dl), AST (< 100 U/L) and total bilirubin (< 0.20 mg/dl).

3. RESULTS

3.1. Hematology

3.2. Erythrocytes

Of the six FeLV+ cats in which erythrocytes were measured, four cats (66.7%) had normal number of erythrocytes, and two had increased number of erythrocytes ($10.34 \times 10^{12}/L$; $11.67 \times 10^{12}/L$).

3.3. Hemoglobin

Of the six FeLV+ cats in which hemoglobin was measured, four cats (66.7%) had normal values of hemoglobin, one cat had increased values of hemoglobin (183 g/L), and one cat had decreased values (83 g/L).

3.4. Hematocrit

Of the six FeLV+ cats in which hematocrit was measured, three cats (50%) had increased levels of hematocrit which varied from up 46.2 to 58.3%, two cats had normal values, and one cat had decreased levels of hematocrit (27.4%).

3.5. MCV

Of the six FeLV+ cats in which MCV was measured, four cats (66.7%) had normal values of MCV, and two cats had increased values (50.0 fL; 52.4 fL).

3.6. MCH

All six FeLV+ cats had normal values of MCH.

3.7. MCHC

All six FeLV+ cats had decreased values of MCHC which varied from up 289 to 315 g/L.

3.8. Platelets

Of the six FeLV+ cats in which platelets were measured, four cats (66.7%) had normal number of platelets, and two had decreased number of platelets ($215 \times 10^9/L$; $266 \times 10^9/L$).

3.9. Leucocytes

Of the six FeLV+ cats in which leucocytes were measured, all six FeLV+ cats had normal number of leucocytes.

3.10. Non-segmented neutrophils

All seven FeLV+ cats had normal values of non-segmented neutrophils.

3.11. Segmented neutrophils

Five of seven FeLV+ cats (71.4%) had decreased values of segmented neutrophils which varied from up 20.0 to 57.0%, and one had increased (77.0%), and one had normal values.

3.12. Lymphocytes

Five of seven FeLV+ cats (71.4%) had increased values of lymphocytes which varied from up 32.0 to 68.0%, and two had normal values.

3.13. Monocytes

All seven FeLV+ cats had normal values of monocytes.

3.14. Eosinophils

Five of seven FeLV+ cats (71.4%) had increased values of eosinophils which varied from up 6.0 to 11.0%, and two had normal values.

3.15. Basophils

All seven FeLV+ cats had basophils values within the normal range.

3.16. Serum biochemistry

3.17. Total serum protein

Five of seven FeLV+ cats (71.4%) had increased total protein levels which varied from up 7.82 to 9.26 g/dl, and two had normal values.

3.18. Albumin

Of the six FeLV+ cats in which albumin was measured, four cats (66.7%) had normal albumin values, and two had increased albumin levels (4.11 g/dl; 4.33 g/dl).

3.19. Globulin

Of the six FeLV+ cats in which globulin was measured, four cats (66.7%) had normal globulin values, and two had increased globulin levels (5.33 g/dl; 5.35 g/dl).

3.20. Albumin/globulin ratio (A/G)

Of the six FeLV+ cats in which A/G ratio was measured, four of six FeLV+ cats (66.6%) had normal A/G ratio, one had decreased (0.11), and one had increased values (1.25).

3.21. Urea

Four of seven FeLV+ cats (57.1%) had increased urea values which varied from up 65.9 to 125.4 mg/dl, and three had normal values.

3.22. Creatinine

Six of seven FeLV+ cats (85.7%) had creatinine values within the normal range, and one had increased values (2.00 mg/dl).

3.23. Aspartate transaminase (AST)

Six of seven FeLV+ cats (85.7%) had normal AST values, and one had increased values (330 U/L).

3.24. Total bilirubin

Six of seven FeLV+ cats (85.7%) had normal total bilirubin values, and one had increased values (4.10 mg/dl).

3.25. Health status

Five of seven FeLV+ cats (71.4%) had no clinical signs suggestive of FeLV infection.

4. DISCUSSION

Increased total protein values were the most frequently observed in FeLV-infected cats. In contrast with my result, a study in Spain (Miró *et al.*, 2007) found normal total protein levels in FeLV+ cats. A Croatian study (Beer *et al.*, 2000) reported increased total protein levels in FeLV+ cats. One FeLV+ cat, had increased total protein and albumin values, but normal values of globulin and the A/G ratio in this study. These data suggested that hyperproteinemia in this cat was caused by dehydration (Beer *et al.*, 2000). Increased A/G ratio was observed in one FeLV+ cat as result of hyperalbuminemia. Decreased A/G ratio was observed in one FeLV+ cat. One Spanish study (Miró *et al.*, 2007) found discretely low A/G ratio in FeLV+ cats.

Renal insufficiency was observed in most FeLV+ cats. Increased urea levels were frequently observed in FeLV+ cats in this study. One cat had increased values of creatinine. FeLV infection may have induced renal insufficiency in these cats (Arjona *et al.*, 2000). A study in Spain (Arjona *et al.*, 2000) reported high urea and creatinine levels in FeLV+ cats.

Liver damage was observed in one FeLV+ cat, because this cat had high AST and total bilirubin levels. FeLV infection may have caused liver damage in this cat (Capozza *et al.*, 2021). Studies in Germany (Gleich & Hartmann, 2009) and Brazil (Lacerda *et al.*, 2020) reported hyperbilirubinemia and increased values of AST in FeLV+ cats.

Anemia was the most frequent hematological abnormality in FeLV+ cats in this study. Thrombocytopenia, increased number of erythrocytes and increased levels of hematocrit were observed in two FeLV+ cats with anemia. In study in Spain (Arjona *et al.*, 2000) 50% of the FeLV+ cats had anemia. A study in Germany

(Gleich & Hartmann, 2009) reported increased number of erythrocytes in 4%, increased levels of hematocrit in 8%, and thrombocytopenia in 36% of the FeLV+ cats.

The most frequently observed alteration of the leukogram included decreased segmented neutrophils with concurrently increased lymphocytes and eosinophils levels. Studies in Spain (Arjona *et al.*, 2000; Collado *et al.*, 2012) reported that neutropenia was the most frequently alteration of the leukogram in FeLV+ cats.

5. CONCLUSION

Anemia, decreased segmented neutrophils with concurrently increased lymphocytes and eosinophils levels were the most frequent hematological abnormalities in FeLV+ cats. Hyperproteinemia was the most frequent alteration of the biochemical parameters in FeLV+ cats. These results suggest that hematological and biochemical parameters are useful diagnostic tools for diagnosis of FeLV infection. However, this study is underpowered for statistical analyses. Therefore, further research using a larger FeLV+ cat population is required.

Conflict of Interest Statement

The author declares that there is no conflict of interest.

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LIST OF ABBREVIATIONS

FeLV: feline leukemia virus

CBC: complete blood count

EDTA: ethylenediaminetetraacetic acid

TRBC: total erythrocyte count

MCV: mean corpuscular volume

MCH: mean corpuscular hemoglobin

MCHC: mean corpuscular hemoglobin concentration

HCT: hematocrit

Hb: hemoglobin

PCV: packed cell volume

TWBC: total leukocyte count

PLT: platelets

A/G: albumin/globulin ratio

AST: aspartate transaminase

IFCC: International Federation of Clinical Chemistry