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Research Article

CHANGES IN HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS IN FELINE PANLEUKOPENIA

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ABSTRACT: One of the most widespread infectious disorders affecting cats is panleukopenia. The feline panleukopenia virus (FPV), which is part of the Parvoviridae family, is the causative agent, and its main clinical symptoms include anorexia, vomiting, diarrhea, neutropenia, and leukopenia. The aim of this research is to assess whether feline panleukopenia (FP) affects hematological and biochemical erythropoiesis parameters. The 84 cats were divided into two groups: case (infected, n = 42) and control (healthy, n = 42) out of the 84 cats with and without a panleukopenia diagnosis. With the use of the VetExpert Rapid Test FPV Ag, FP was diagnosed. An enzyme-linked immunosorbent assay was used to detect FPV. A Semi-automatic Chemistry Analyzer (HTI Diagnostics, USA) was used to conduct hematological and biochemical studies. The hepatorenal syndrome was diagnosed based on the presence of pancreatitis (glucose levels rose by 31%), hyperenzymemia of alpha-amylase, significantly elevated total bilirubin, 20% elevated blood protein levels, and elevated creatinine and urea levels. The mean corpuscular hemoglobin concentration was 22% lower on average (p≤0.05), which is significantly lower. The cause of panleukopenia in cats is complicated, with typical alterations in the biochemical and hematological parameters as well as the development of multiple organ failure and immunosuppression (a 50% reduction in leukocytes).

Keywords: Feline panleukopenia, Feline panleukopenia virus, Erythropoiesis, Cats, Blood analysis.

INTRODUCTION

Keeping companion animals is becoming a practice for people worldwide. So, the development of techniques for the diagnosis, prevention, and treatment of their various health problems now becomes a challenge. Among all the important diseases of canines and felines, diseases due to microbial infections contribute to a very large section [1, 2, 3], and among them, a good number of such diseases are due to infection with different viruses [4, 5]. Parvovirus infects many animals and people, and some strains of parvovirus infection in domestic animals are difficult to manage due to fast mutation, tolerance to environmental conditions, the production of a huge number of viruses, and cross-species transmission [6]. The feline panleukopenia virus (FPV), a member of the Parvoviridae family, is the cause of panleukopenia, which is still one of the most prevalent viral disorders in cats [7]. The primary clinical symptoms are anorexia, vomiting, diarrhea, neutropenia, and leukopenia. Changes in blood parameters, both quantitative and qualitative, can be used to detect pathological processes within the body. As a result, blood tests provide crucial information about the health of the animal and

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aid in the early detection of pathological processes that lead to disease when there aren't yet any outward symptoms [8]. The majority of disorders can be quickly and affordably diagnosed with a blood test. Because hematological and biochemical data are used to diagnose many disorders, it is crucial to evaluate the metabolism of domestic cats. A relatively small number of studies have been done on the erythropoiesis, hematological, and biochemical parameters in cats for infectious illnesses with viral etiologies. The objective of this study is to assess how feline panleukopenia (FP) affects hematological and biochemical erythropoiesis parameters.

MATERIALS AND METHODS

Experimental animals and design

The 84 cats with and without the diagnosis of panleukopenia were divided into two groups: case (infected, n = 42) and control (healthy, n = 42), performed under the Department of Veterinary Sanitary Expertise, Histology and Pathology, Kyrgyz National Agrarian University, Bishkek, Kyrgyzstan. Based on clinical signs (high fever, lethargy, vomiting, generalized depression, loss of appetite, diarrhea, nasal discharge, and dehydration) and the results of diagnostic tests, the diagnosis of panleukopenia is confirmed in cats (n = 42) after a detailed study of the hematological and biochemical parameters of the blood. The diagnosis of FP was carried out with the VetExpert Rapid Test FPV Ag (Quadratech Diagnostics, United Kingdom). The detection of FPV was carried out using an enzyme-linked immunosorbent assay (ORGENTEC, Germany). Hematological and biochemical studies were performed using a Semi-automatic Chemistry Analyzer (HTI Diagnostics, USA).

Hematological analysis

A hematological analysis of blood was carried out, and based on the obtained results, erythrocytes were measured by mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, and mean corpuscular volume.

Biochemical analysis

Biochemical analysis of blood was carried out using the refractometric determination of serum protein concentration, the colorimetric determination of urea using mixed color reagent (diacetyl monoxime, thiosemicarbazide), the Aspartate aminotransferase (AST/GOT) activity assay kit (Reitman-Frankel Method), and creatinine measured by Jaffe's reaction. Blood was collected from the superficial vein of the forearm and the medial saphenous, or subcutaneous vein of the leg.

Blood sampling

Blood sampling to determine the hematological and biochemical parameters was carried out in compliance with bioethical standards for the treatment of animals as per the European Convention for the Protection of Pet Animals.

Statistical analysis

The obtained data are presented as the mean ± standard deviation. Statistical analysis was performed using Excel.XLSTAT v2020.1 (Microsoft, Addinsoft, France) and Statistica v11.0 (StatSoft Inc., USA). The Mann-Whitney test was used to assess the significance of differences between the groups. Three levels of probability ($p \leq 0.05$, $p \leq 0.01$, and $p \leq 0.001$) were calculated.

RESULTS AND DISCUSSION

The early signs of FP include lethargy, fever, anorexia, polydipsia, vomiting, and diarrhea (less often). First, we looked at differences in blood hematological parameters between panleukopenic animals and healthy cats (Table 1).

The results of hematological tests showed that the number of erythrocytes dropped by 26%, which is due to the presence of a virus in the patient's blood [9], which causes hemolysis. According to Boos *et al.* (2015), FPV impacts the red bone marrow, which is linked to hypoxia because of the underlying cardiovascular illness. As the virus quickly multiplies in bone marrow cells, there was also a significant 45% reduction in the number of leukocytes seen in the case group ($p \leq 0.01$) [10].

Because enteritis may be related to blood loss, a 30% increase in platelet count was shown to be statistically significant ($p \leq 0.01$) [11]. With the onset of eosinophilic gastroenteritis, the number of eosinophils in the case group considerably increased ($p \leq 0.05$) [12]. The shift to the left was characterized by a large ($p \leq 0.001$) increase in neutrophils [13]. The results of Awad *et al.* (2018) are comparable to the hematological alterations in our study's case group [6]. The hematocrit value, however, declined in the control group by 37.6±1.3 % while remaining within the normal range of 30.3±3.9 % in the case group (Table 1).

Table 1. Hematological parameters of blood in cats with panleukopenia.

Hematological parameters	Normal values	Control group (n = 42) (Mean ± SD)	Case group (n = 42) (Mean ± SD)
Erythrocytes, T/l	5.3-9.5	7.9 ± 0.4	6.2 ± 0.3**
Platelets, G/l	300-630	236 ± 14.6	421.5 ± 35.1**
Leukocytes, g/l	5.5-8.5	9.2 ± 1.5	4.2 ± 1.2**
Basophils, %	1-3	3.2 ± 1.2	9.1 ± 1.3
Neutrophils, %	33-75	45.7 ± 5.1	58.1 ± 1.8***
Eosinophils, %	0-4	2.1 ± 0.5	2.9 ± 0.3*
Monocytes, %	1-4	1.8 ± 0.3	6.9 ± 0.6***
Lymphocytes, %	22-55	29.5 ± 3.1	33.8 ± 4.2
Hematocrit value, %	26-48	37.6 ± 1.3	30.3 ± 3.9
Erythrocyte sedimentation rate, mm/h	1.0-13.0	4.2 ± 0.6	27.6 ± 1.3***

*p < 0.05; **p < 0.01; ***p < 0.001.

Table 2. Biochemical parameters of erythropoiesis in cats with panleukopenia.

Hematological parameters	Normal values	Control group (n = 42) (Mean ± SD)	Case group (n = 42) (Mean ± SD)
Mean corpuscular hemoglobin concentration, pg	14-19	16.2 ± 1.5	18.1 ± 0.3
Mean corpuscular hemoglobin concentration, g/dL	31-38.5	35.5 ± 3.1	29.8 ± 1.9*
Mean corpuscular volume, fl	39-50	46.6 ± 2.6	45.6 ± 1.2
Hemoglobin, g/l	80-150	134 ± 7.8	123.6 ± 5.3
Total protein, g/l	54-77	69.7 ± 1.8	84.3 ± 4.6**
Albumins, g/l	22-32	33.7 ± 1.5	32.6 ± 1.3
Globulins, g/l	30-50	38.6 ± 1.9	52.6 ± 3.1***
Creatinine, µmol/l	70-165	93.7 ± 7.1	209.5 ± 31.9***
Urea, mmol/l	2.0-8.0	8.9 ± 0.6	16.9 ± 2.6**
Glucose, mmol/l	3.2-6.4	6.2 ± 0.4	5.9 ± 0.8*
Gamma-glutamyl Transferase, units/l	1.8-10	2.9 ± 0.3	2.8 ± 0.5
Alkaline phosphatase, units/l	8.0-28.0	25.6 ± 2.5	26.9 ± 3.1
Total bilirubin, µmol/l	3.0-12.0	5.2 ± 0.6	25.4 ± 7.2**
Alanine transaminase, units/l	19-52.5	38.5 ± 2.8	46.6 ± 4.3
Aspartate transaminase, units/l	9-29	19.5 ± 3.2	58.3 ± 6.6***
De-Ritis ratio	1.3-1.6	1.4 ± 0.6	1.87 ± 0.2
α-Amylase, unit/l	450-1550	881 ± 33.6	1598.6 ± 128.4***

*p < 0.05; **p < 0.01; ***p < 0.001.

Cats with panleukopenia had their blood biochemical parameters and markers of erythropoiesis investigated and compared with healthy cats (Table 2).

According to a study by Sykes (2014), changes in markers such as a threefold increase in aspartate aminotransferase hyperenzymemia and a significant 20% increase in total bilirubin and serum protein levels can show how FPV impacts the morpho-functional state of the liver [11].

According to Kamal (2014), the urinary system appears to have a significant two-fold increase in urea level and creatinine concentration, respectively [14].

Comparing the control group to the case group, the glucose concentration was significantly higher in the control group. This could be a result of panleukopenic cats' poor stress tolerance. During blood collection, healthy cats produce cortisol and norepinephrine, which cause hyperglycemia and lymphopenia [15, 16]. The findings of Cotmore *et al.* (2014) are consistent with the results of the study of biochemical parameters in FP, particularly a substantial rise ($p \leq 0.05$) in glucose concentration by 31% and a considerable hyperenzymemia of alpha-amylase ($p \leq 0.001$) associated with pancreatic illness [17].

Hemoglobin levels, alanine transaminase activity, and alkaline phosphatase activity were all within normal ranges. In this study, the case group's ESR levels were significantly ($p \leq 0.001$) higher than the control groups.

This was because there were more acute-phase proteins in their plasma, including fibrinogen, C-reactive protein, and immunoglobulins. The case group's erythrocyte indices did not substantially vary from those of the control group. A 22% drop in the mean corpuscular hemoglobin concentration ($p \leq 0.05$) showed maturation of erythrocytes and oxygen saturation of hemoglobin in the bone marrow. The findings of our study on the hematological and biochemical parameters of erythropoiesis in FPV-infected cats are consistent with the results reported by Gerlach *et al.* (2017) [4].

CONCLUSION

From the study, it can be concluded that the cats with panleukopenia have a complex pathogenesis with characteristic changes in the hematological and biochemical parameters and the development of multiple organ failure with immunosuppression (leukocytes decreased by 45%). The hepatorenal syndrome was observed and showed highly elevated total bilirubin, serum protein levels elevated by 20%, elevated creatinine, and urea levels, pancreatitis (glucose levels elevated by 31%), and hyperenzymemia of alpha-amylase. The development of anemia showed a significant decrease in the average concentration of hemoglobin in a single erythrocyte by 22%.

REFERENCES

1. Singh J, Singh RS, Singh H, Gupta DK, Randhawa SS. Clinical and haemato-biochemical observations in dogs naturally infected with canine monocytic ehrlichiosis. Explor Anim Med Res. 2021; 11(2), DOI: 10.52635/eamr/11.2.214-219.

2. Chethan GE, Sarma K, Bora N, Manjunathachar HV, Thakur N *et al. Leptotrombidium deliense* infestation in domestic dogs from India, a vector of scrub typhus: a case report. Explor Anim Med Res. 2022; 12(1), DOI: 10.52635/ eamr/ 12.1.118-123.

3. Sivajothi S, Reddy BS, Swetha K. Clinical, haemato-biochemical and electrocardiographic studies in Persian breed cats with haemobartonellosis. Explor Anim Med Res. 2023; 13(1), DOI: 10.52635/eamr/ 13.1.131-135.

4. Gerlach M, Proksch AL, Unterer S, Speck S, Truyen U, Hartmann K (2017) Efficacy of feline anti-parvovirus antibodies in the treatment of canine parvovirus infection. J Small Anim Pract. 2017; 58(7): 408-415.

5. Gülersoy E, Yavuz U, Yener K. Clinical manifestation of Canine coronavirus enteritis and intestinal intussusception as its complication. Explor Anim Med Res. 2023; 13(1), DOI: 10.52635/eamr/13.1.111- 116.

6. Awad RA, Khalil WKB, Attallah AG. Epidemiology and diagnosis of Feline panleukopenia virus in Egypt: Clinical and molecular diagnosis in cats. Vet World. 2018; 11(5): 578-584.

7. Stuetzer B, Hartmann K. Feline parvovirus infection and associated diseases. Vet J. 2014; 201(2): 150-155.

8. Caswell JL, Hewson J, Slavic Đ, DeLay J, Bateman K. Laboratory and postmortem diagnosis of bovine respiratory disease. Vet Clin North Am Food Anim Pract. 2012; 28(3): 419 - 441.

9. McCullough J. RBCs as targets of infection. Hematology Am Soc Hematol Educ Program 2014; 2014(1): 404-409.

10. Boes KM, Durham AC. Bone Marrow, Blood Cells, and the Lymphoid/Lymphatic System. Pathologic Basis of Veterinary Disease, e2, 2017; 724-804.

11. Sykes JE. Feline panleukopenia virus infection and other viral enteritides. Canine Feline Infecti. 2014; 187-194.

12. Ingle SB, Hinge Ingle CR. Eosinophilic gastroenteritis: an unusual type of gastroenteritis. World J Gastroenterol. 2013; 19(31): 5061-5066.

13. Ishimine N, Honda T, Yoshizawa A, Kawasaki K, Sugano M *et al.* Combination of white blood cell count and left shift level real-timely reflects a course of bacterial infection. J Clin Lab Anal. 2013; 27(5): 407-411.

14. Kamal A. Estimation of blood urea (BUN) and serum creatinine level in patients of renal disorder. Indian J Fundam Appl Life Sci. 2014; 4(4): 199-202.

15. Okutsu M, Ishii K, Niu KJ, Nagatomi R. Cortisol-induced CXCR4 augmentation mobilizes T lymphocytes after acute physical stress. Am J Physiol Regul Integr Comp Physiol. 2005; 288(3): R591-R599.

16. Rand JS, Kinnaird E, Baglioni A, Blackshaw J, Priest J. Acute stress hyperglycemia in cats is associated with struggling and increased concentrations of lactate and norepinephrine. J Vet Intern Med. 2002; 16(2): 123-132.

17. Cotmore SF, Agbandje-McKenna M, Chiorini JA, Mukha DV, Pintel DJ *et al.* The family Parvoviridae. Arch Virol. 2014; 159(5): 1239-1247.

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