

Hematological and biochemical parameters in cats with feline panleukopenia: A case report

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Abstract. Feline panleukopenia (FP) is a highly contagious and often fatal viral disease of domestic and wild felids caused by the feline panleukopenia virus (FPV), that belongs to the Parvoviridae family. The disease predominantly affects kittens and unvaccinated cats, with transmission occurring through direct contact with infected animals or indirect exposure to contaminated secretions, fomites, or environments. Our study aimed to investigate the impact of FPV infection on hematological and biochemical parameters, particularly those associated with erythropoiesis. We examined two domestic cats under one year of age, named UP and CI. Clinical evaluation included anamnesis, physical examination, and assessment of vital parameters, while FPV infection was confirmed using the VetExpert Rapid FPV Antigen Test and confirmed by polymerase chain reaction (PCR). Initial anamnesis when the cats were presented demonstrated that the cats had loss of appetite and dehydration without a history of vomiting, but only one cat (UP) developed pasty diarrhea. Hepatorenal syndrome was diagnosed based on signs of pancreatitis, which included elevated glucose levels, increased Alanine Aminotransferase (ALT) levels, significantly high total bilirubin levels, and lower levels of blood protein, creatinine, and urea. Hematological assessment demonstrated panleukopenia, with leukocyte counts reduced by approximately 50%. These findings indicate that FPV infection induces profound hematological and biochemical alterations, reflecting multisystem dysfunction and severe immunosuppression. The results highlight the complexity of FPV pathogenesis and emphasize the importance of early diagnostic screening and intensive supportive therapy to mitigate morbidity and mortality in young cats.

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1 Introduction

The practice of pet ownership has become prevalent globally. Consequently, formulating methodologies to diagnose, prevent, and manage their diverse health issues presents a challenge for veterinarians. Microbial infections constitute the predominant category of diseases in dogs and cats. A significant proportion of these disorders are caused by infections with various viruses [1, 2].

Feline Panleukopenia Virus is an extremely infectious and lethal ailment affecting felines. [3]. FPV is a diminutive, non-enveloped, single-stranded DNA virus classified under the Parvoviridae family. It exhibits genetic, structural, and antigenic similarities with canine parvovirus (CPV), which is capable of infecting felines (CPV strains 2a, 2b, and 2c). This virus exhibits a distinct tropism for tissues characterized by elevated mitotic activity, including lymphoid tissue, bone marrow and intestinal crypt cells. FPV can induce a diverse range of symptoms contingent upon the severity of the virus strain, the host's health condition, and the existence of co-infections [2, 5]. The death rate in the peracute phase of infection may attain 100%. The mortality rate in the acute type is approximately 90% [6]. The principal clinical manifestations include anorexia, vomiting, diarrhea, neutropenia, and leukopenia [5].

Alterations in blood parameters, both quantitative and qualitative, can indicate disease processes within the body. Consequently, blood tests furnish essential insights into the animal's health and facilitate the early identification of pathological processes that may result in disease prior to the manifestation of any external signs [6,7]. The majority of illnesses can be rapidly and economically detected by a blood test. Understanding feline metabolism is essential, as hematological and biochemical data are utilized to identify numerous illnesses.

A limited number of studies have been performed on erythropoiesis, hematological, and biochemical parameters in felines with viral infectious diseases. This study aims to evaluate the impact of feline panleukopenia on hematological and biochemical markers of erythropoiesis. The aim of this study is to evaluate the impact of feline panleukopenia on hematological and biochemical markers of erythropoiesis.

2 Materials and Methods

2.1 Subjects

This research involves two cases from two patients who were registered and treated at the veterinary clinic. A diagnosis of panleukopenia was confirmed in the two cats (n = 2) based on clinical symptoms (high fever, lethargy, overall depression, loss of appetite, diarrhea, nasal discharge, and dehydration) and the findings from diagnostic tests, following a thorough examination of their blood's haematological and biochemical parameters. The FP diagnosis was conducted using the VetExpert Rapid Test FPV Ag (Quadrant Diagnostics, United Kingdom). In Case 1, a 4-month-old male mixed-breed cat showed signs of anorexia, lethargy, and diarrhea. The clinical examination indicated fever (40.1°C), moderate dehydration (3/5), a heart rate of 80 bpm, and a respiratory rate of 68 bpm. The cat's overall condition was assessed as poor. In Case 2, a 6-month-old female mixed-breed cat presented with two days of anorexia and watery diarrhea. This cat was found to be hypothermic (36.1°C), had a weak body condition (2/5), tachycardia (160 bpm), tachypnea (40 bpm), and was clinically dehydrated.

2.2 Methods

2.2.1 Hematological Analysis

The complete blood count (CBC) was determined using an automated hematology analyzer (Sysmex Corporation, Hyogo, Japan) to measure red blood cell (RBC), packed cell volume (PCV), hematocrit (HCT), white blood cells (WBC), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC).

2.2.2 Biochemical analysis

Serum was acquired through the centrifugation of whole blood, and the isolated fractions were preserved at -20°C until biochemical assays were conducted. All samples were aliquoted before storage to avoid repeated freeze-thaw cycles, thus preserving sample integrity. Biochemical parameters were assessed utilizing commercially available reagents and kits from Biocheck, including liver function indicators such as aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), and gamma-glutamyl transferase (GGT). The protein profile was evaluated, encompassing total protein (TP), albumin (ALB), globulin (G), and the albumin-to-globulin (A/G) ratio. The assessed kidney function markers comprised blood urea nitrogen (BUN) and creatinine levels.

3 Results

The initial manifestations of feline panleukopenia (FP) encompass lethargy, fever, anorexia, polydipsia, vomiting, and, less frequently, diarrhea. Both felines exhibited gastrointestinal symptoms, including anorexia and diarrhea; however, their systemic clinical characteristics varied. Cat 1 presented with fever, mild dehydration, changed mental status, and hemorrhagic diarrhea, signifying a deteriorated general condition. Conversely, Cat 2 had indications of hypothermia, tachycardia, tachypnea, and significant dehydration.

The hematological findings of both cats are summarized in Table 1. Cat 1 showed red blood cell (RBC), hemoglobin (HGB), and hematocrit (HCT) within the normal reference range, as well as MCV, MCH, and MCHC. However, the total white blood cell (WBC) count was markedly decreased. Meanwhile, Cat 2 exhibited lower RBC, HGB, and HCT values compared with Cat 1. The MCV and MCH were higher than the reference values, while MCHC remained within normal limits. The WBC count in Cat 2 was also below the reference interval but higher than that of Cat 1.

Table 1. Hematology results of cats

Parameters	Unit	References [8]	Cat 1	Cat 2
RBC	$10^6/\text{mm}^3$	5-10	7,28	4,86
HGB	g/dL	8-15	10,3	8,13
HCT	%	24-45	45	25,8
MCV	fL	41-54	43,3	45,6
MCH	pg	13,5-17,5	20,2	33,3
MCHC	g/dL	31-36	39,8	37,6
WBC	$10^3/\text{mm}^3$	5,5-19,5	0,48	0,15

Cats with panleukopenia had their blood biochemical parameters and erythropoiesis markers assessed (see Table 2). The results indicated elevated levels of aspartate aminotransferase, total bilirubin, and alanine transaminase. In contrast, the levels of albumin, globulins, creatinine, and BUN were found to be decreased.

Table 2. Biochemical parameters of cats with panleukopenia

Parameters	Unit	References [9]	Cat 1	Cat 2
Total protein	gr/dL	6,0-7,5	5,3	4,2
Albumins	gr/dL	2,4-4,1	1,9	2,2
Globulins	gr/dL	3,4-5,2	2,4	3,0
Creatinine	mg/dL	0,8-2,3	0,4	0,7
BUN	mg/dL	15,0-34,0	14,7	11,7
Glucose	mg/dL	70-150	177	202
Total bilirubin	Mg/dL	0,0-0,4	11,3	5,1
Alanine transaminase	IU/L	28,0-76,0	81,5	150,5
Aspartate transaminase	IU/L	5,0-55,0	27,2	44,0
α -Amylase	IU/L	500-1500	1598	1688

4 Discussions

Feline panleukopenia virus is among the most infectious and lethal viruses impacting the global cat population. Despite standard immunization protocols, the prevalence of FPV is rising among cats in Yogyakarta. Detection of FPV in suspected cases is conducted using rapid antigen tests, serological tests, and *polymerase chain reaction* assays [1,5,7]. In cases of FP, the severity of clinical symptoms may vary depending on factors such as age, immune status, and comorbidities. The findings can vary from a subclinical infection to peracute syndrome, characterized by rapid mortality [10]. In older cats, the most common non-specific symptoms include poor appetite, lethargy, fever, dehydration, vomiting, and diarrhea [11]. These signs are more prevalent in senior cats. After being transmitted from feces to the mouth, the virus primarily multiplies in the macrophages of the oropharynx and regional lymph nodes. It then spreads throughout the body [10, 11]. The virus replicates and damages the villi in the digestive tract, leading to malabsorption, increased permeability, and worsened clinical signs [3,9]. This is due to the fact that intestinal crypt cells are also considered to be mitotically active. In most cases, death is caused by complications such as bacterial translocation, secondary bacterial infections, sepsis, dehydration, and disseminated intravascular coagulopathy (DIC) [12]. Among the clinical signs found in cats with FP, fever, loss of appetite, dehydration, and diarrhea were more pronounced than others in this study. Other clinical findings included diarrhea and dehydration. This effect is linked to the fact that the virus primarily targets intestinal epithelial cells that divide rapidly.

The assessment of laboratory data and its comparison with reference values is crucial in standard practice. The diagnosis of FP is confirmed through the detection of FP antigen in feces; however, it is crucial to assess the patient's history, clinical symptoms, and hematologic abnormalities [11]. The virus infects many organs, including lymphoid tissue, leading to decreased cellularity and resulting in immunosuppression due to cell-free viremia [7,9,10]. Consequently, atypical leukogram patterns are prevalent in felines with feline panleukopenia. The principal observation is a reduction in the overall white blood cell count, marked by neutropenia and lymphopenia [12]. This investigation revealed reduced WBC levels. The atypical leukogram patterns seen in this study can be attributed to a direct cytopathic action of the virus on the bone marrow. Moreover, factors that facilitate the onset

of cytopenia, chronic or cyclic neutropenia, and lymphopenia encompass thymic atrophy, myelosuppressive syndrome, and paracortical lymph node depletion [13].

An elevation in aspartate aminotransferase levels, along with a significant increase in total bilirubin and serum protein levels, may indicate the effects of FPV on hepatic structure and function. The findings indicated an elevation in total serum protein, presumably resulting from inadequate stress tolerance in panleukopenic felines. In the course of blood sample, healthy felines generate cortisol and norepinephrine, resulting in hyperglycemia and lymphopenia [14, 15]. The research conducted by Cotmore et al. (2014) corroborates previous studies on biochemical markers in feline panleukopenia, indicating that cats infected with FPV had elevated glucose levels and a significant increase in alpha-amylase associated with pancreatic dysfunction. The activities of alkaline phosphatase and alanine transaminase, as well as hemoglobin levels, were all within the normal range.

5 Conclusion

This report documents two cases of confirmed with feline panleukopenia virus, each presenting with distinct clinical and hematological features. Cats afflicted with panleukopenia exhibit a complicated pathophysiology characterized by distinct alterations in hematological and biochemical parameters, leading to multiple organ failure and immunosuppression.

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