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Haemato-biochemical alteration in cats infected with feline panleukopenia

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Abstract
The present study was conducted at Department of Veterinary Medicine, Veterinary College Hospital, Bengaluru to study the haematological and serum biochemical changes in cats affected with feline panleukopenia (FPL). Ten apparently healthy cats and 38 cats with FPL were selected for the present study. The blood samples were collected from cephalic or saphenous vein under aseptic conditions and subjected to haematological and biochemical analysis. The major haematological changes observed in cats affected with FPL in comparison with healthy cats were Leukopenia, thrombocytopenia, anaemia. The major biochemical changes recorded were increased AST and creatinine, hypoproteinaemia and hypoalbuminemia.

Keywords: Feline panleukopenia (FPL), leukopenia

Introduction
Feline panleukopenia (FPL) is a serious acute viral disease having high mortality and morbidity among kittens which have not been properly vaccinated. The disease is caused by FPLV virus and characterized by anorexia, severe dullness/depression, pyrexia, vomiting and diarrhoea [5]. FPLV is closely related to canine parvovirus (CPV), mink enteritis virus and racoon parvovirus [10]. FPLV is transmitted vertically by intrauterine transmission from mother to foetus and horizontally by the faeco-oral route from infected cats and their secretions/excretion coming into direct/indirect contact [5].
FPLV has high affinity towards rapidly dividing cells of bone marrow, lymphoid tissue and mucosal epithelial cells of the intestinal crypts resulting in severe immunosuppression and enteritis respectively. The mortality and morbidity rates are highest in kittens under the age of one year. In per acute and acute infections, the mortality rates may go up to 90 to 100 per cent and 25 to 90 per cent respectively. FPLV can cause devastating outbreaks in cat-holding facilities such as catteries, multiple cat households and animal shelters on several occasions. Rapid detection of FPV in clinical settings may thus play a critical role in minimising FPV related deaths[5]. Diagnosis of FPL can be done with minimum clinical setup using history, physical and clinical finding, also by hemato-biochemical changes. Haematological and serum biochemical analysis are frequently used as primary line diagnosis. The objective of the present study was to know the haematological and biochemical changes in cats affected with FPL.

Material and Methods
The present study entitled "Studies on Feline Panleukopenia in and around Bengaluru" was undertaken based on clinical cases of cats suspected for feline panleukopenia. The study population was selected from the domestic cats presented to Veterinary College Hospital, Hebbal, Bengaluru during the period August 2021 to January 2022 with clinical signs of anorexia, dullness, pyrexia, vomiting and diarrhoea and considered as infected group (Group II). Also 10 apparently healthy cats were selected for control group of study (Group I).
The blood samples were collected from cephalic or saphenous vein under aseptic conditions and divided into two parts. One part was immediately transferred to EDTA vacutainer to analyse haematological parameters. The other part was transferred to vacutainer containing clot activator for serum separation to analyze biochemical parameters. All the haemato-biochemical parameters were estimated on the same day of collection. Haematological parameters such as total leukocyte count (TLC), total erythrocyte count (TEC), haemoglobin

(Hb), packed cell volume (PCV), Erythrocyte cell indices (MCV, MCH, MCHC) and platelet count were estimated by Mindray Auto Haematology Analyzer BC 2800 Vet. The biochemical parameters such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatinine, blood urea nitrogen (BUN), total protein (TP), albumin, globulin and A/G ratio were estimated using Micro Lab RX-50 using the reagent kits (ErbaR) supplied by Transasia Bio- Medicals Ltd. as per the manufacturer's instruction. The data obtained were subjected to statistical analysis by using statistical software - IBM SPSS Statistics v24. Independent t-test was performed to compare the control group and cats with FPL at 95% confidence level.

Results and Discussion

Haematological findings

In the present study, various haematological parameters of 38 cats with feline panleukopenia were compared with 10 healthy cats. The predominant haematological alterations were leukopenia, anaemia and thrombocytopenia. Total leukocyte count (TLC) in group II cats was 2.82±0.71 × 10^3 /µL which was significantly decreased than that of the TLC of group I cats (12.15±0.91 × 10^3 /µL). In group II cats 39.47 per cent cats had TLC of <1 x 10^3 /µL, 34.21 per cent had TLC between 1 x 10^3 to 3 x 10^3/ µL, 18.42 per cent cats had TLC between 3 x 10^3 to 5 x 10^3/µL and 7.89 per cent cats had TLC >5 x 10^3/µL. The reduction in total leukocytes in group II may be attributable to bone marrow destruction and viral replication in mitotically proliferating myeloid and lymphoid cells, which destroys myeloid and lymphoid precursor cells [1, 2, 8, 11]. FPV kills both erythroid and myeloid colony progenitor cells leukopenia was a characteristic finding in feline panleukopenia [9].

The mean total erythrocyte count (TEC) in healthy and FPL infected group cats were 9.61±0.56 × 10^6 /µL and 7.78±0.37 × 10^6 /µL, respectively. There was statistically significant decrease (p>0.05) in mean TEC of infected cats when compared to healthy groups. The mean haemoglobin levels in healthy cats was 14.5±0.85 g/dl and FPL infected cats was 11.72±0.53 g/dl. A statistically significant (p<0.01) anaemia in FPL infected cats was observed when compared with healthy cats. The mean packed cell volume (PCV) of healthy and feline panleukopenia affected cats were 40.46±1.52 per cent and 33.75±1.36 per cent respectively. There was a statistically significant decrease (p≤0.05) in PCV values of infected group when compared to healthy cats.

Parvoviral enteritis causes the release of Interleukin-6, which inhibits the release of hepcidin and reduces the synthesis of ferroportin, affecting erythropoiesis [7]. Abnormal iron uptake and metabolism in the inflamed intestine, together with gastrointestinal bleeding and shortened RBC life, could be the reason for anaemia in case of FPV infections [1].

In the present study, the mean corpuscular volume and mean corpuscular haemoglobin values of the infected group were 40.96±0.92 fL and 14.37±0.31 pg, respectively, which were non-significantly lower than the MCV and MCH of the control group, which were 43.91±0.94 fL and 14.62±0.26 pg. Mean corpuscular haemoglobin concentration of FPV infected cats was 35.89±0.51g/L which was significantly higher than control group (32.99±0.63 g/L). Decreased level of MCV and MCH with increased levels of MCHC has been attributed to the development of microcytic hypochromic anaemia [4].

The mean platelet counts of healthy and infected cats was 252.3±26.64 X 10^3 /µL and 96.53±14.98 X 10^3 /µL respectively. There was statistically significant (p<0.01) decrease in mean platelets of infected group when compared to healthy cats. Thrombocytopenia was a variable aspect of feline panleukopenia in cats that develops DIC, as well as a result of direct bone marrow injury that could occur in conjunction with leukopenia in the early stages of infection [5].

Serum biochemical findings

In the present study, the biochemical parameters such as ALT, AST, creatinine, BUN, total protein, albumin, globulin and A/G ratio of FPL infected cats were compared with healthy control group of cats in which no statistically significant difference was observed in serum ALT, BUN and globulin levels between infected cats and healthy cats. The increased levels of AST, increased level of creatinine, hypoproteinemia, hypoalbuminaemia and decreased A/G ratio were noticed in FPL infected cats when compared to healthy cats.

The mean serum alanine amino transaminase (ALT) in healthy and FPL infected cats was 53.65±13.24 IU/L was 60.88±5.03 IU/L respectively. Increase in mean values of ALT was observed in infected cats but there was no statistically significant difference (p>0.05) between healthy and infected cats.

The mean serum aspartate amino transaminase (AST) level in healthy cats was 38.32±4.60 IU/L and infected cats was 55.27±4.13 IU/L. There was statistically significant (p<0.05) increase in AST level of infected cats when compared to healthy cats. In the present study, increased AST levels in FPL infected cats might be due to enteritis leading to more production and leakage into the body [3]. Hepatic hypoxia due to severe hypovolemia or the absorption of a toxic substance through the damaged gastrointestinal tract might be the reason for increase in AST values [6].

The mean serum creatinine level in healthy cats was found to be 0.96±0.08 mg/dl and in FPL infected cats, it was 1.34±0.08 mg/dl. There was statistically significant (p<0.05) increase in serum creatinine level of FPL infected cats when compared to healthy cats. The mean blood urea nitrogen levels in healthy cats was 22.77±2.34 mg/dL, while that of infected group of cats, it was 27.17±1.85 mg/dL. Even though the mean values of the infected group were higher, there was no statistical significance difference (p>0.05) in the blood urea nitrogen values of the healthy control group when compared to the infected group.

Increase in the serum creatine and blood urea nitrogen in feline panleukopenia affected cats might be due to ability of virus to produce pre-renal/non-renal azotaemia by causing severe dehydration in the result of vomiting and diarrhoea. Although the virus could produce minimal renal pathologic effects prerenal/non-renal azotaemia is a major cause [5].

The mean serum total protein in healthy and feline panleukopenia infected cats were 5.98±0.20 g/dl and 4.84±0.24 g/dl, respectively. Statistically, there was a significant decrease (p<0.05) in total protein value of feline panleukopenia infected cats when compared to healthy cats. The mean serum albumin level in healthy cats was 3.46±0.17 g/dl, while that of cats infected with feline panleukopenia was 2.17±0.13 g/dl. There was statistically significant (p>0.01) decrease in mean albumin values of infected cats when compared to healthy cats. The mean serum globulin levels were found to be 2.52±0.14 g/dl in healthy cats and 2.67±0.16 g/dl in infected cats. There was statistically non-significant increase (p<0.05) in globulin levels of infected cats when compared to healthy cats. Based on present study it is

concluded that reduced protein absorption and increased protein leakage into the gastrointestinal tract owing to epithelial mucosal lesions might be the reason for hypoproteinemia and hypoalbuminemia in FPV infected cats.

Serum albumin concentration less than 3 g/dL at present study was associated with a negative outcome in FPL affected cats which might be due to the association between hypoalbuminemia and decreased plasma colloid osmotic pressure and results in reduction in effective perfusion at the capillary level followed by DIC, organ failure, and death [8].

The mean serum albumin-globulin (A/G) ratio levels in healthy cats and cats infected with feline panleukopenia were 1.471±0.17 and 0.92±0.07 respectively. There was statistically significant (p>0.01) decrease in the serum albumin-globulin ratio in feline panleukopenia infected cats when compared to healthy cats. In the present study, lower A/G ratio might be due to decreased albumin level in cats infected with feline panleukopenia as a result of diarrhoea causing loss of proteins due to intestinal epithelium damage, as well as malabsorption of nutrients through the intestine due to damaged and shortened villi.

Table 1: Haematological parameters in control and FPL affected group of cats

Haematological Parameter	Mean Values±SE		t Value	p Value
	Group I (n=10)	Group II (n=38)		
TLC (× 10^3/µL)	12.15±0.91	2.82±0.71	6.335**	0.000
TEC (× 10^6/µL)	9.61±0.56	6.01±0.22	6.924**	0.000
Hb (g/dl)	14.5±0.85	11.72±0.53	2.457*	0.018
PCV/HCT (%)	40.46±1.52	33.75±1.36	2.403*	0.020
MCV (fL)	43.91±0.94	40.96±0.92	1.583^{NS}	0.120
MCH (pg)	14.62±0.26	14.37±0.31	0.406^{NS}	0.687
MCHC (g/dl)	32.99±0.63	35.89±0.51	2.77**	0.008
PLT (× 10^3/µL)	252.3±26.64	96.53±14.98	4.825**	0.000

NS: Non-Significant at p>0.05 level; * Significant at p≤0.05 level; ** Significant at p≤0.01 level

Table 2: Serum biochemical parameters in control and FPL affected group of cats

Serum biochemical Parameter	Mean Values±SE		t Value	p Value
	Group I (n=10)	Group II (n=38)		
ALT (IU/L)	53.65±13.24	60.88±5.03	0.609^{NS}	0.545
AST (IU/L)	38.32±4.60	55.27±4.13	2.009*	0.050
Creatinine (mg/dL)	0.96±0.08	1.34±0.08	2.478*	0.017
BUN (mg/dL)	22.77±2.34	27.17±1.85	1.152^{NS}	0.255
Total protein (g/dL)	5.98±0.20	4.84±0.24	2.389*	0.021
Albumin (g/dL)	3.46±0.17	2.17±0.13	4.904**	0.000
Globulin (g/dL)	2.52±0.14	2.67±0.16	0.445^{NS}	0.658
A/G ratio	1.471±0.17	0.92±0.07	3.349**	0.002

NS: Non-Significant at p>0.05 level; * Significant at p≤0.05 level; ** Significant at p≤0.01 level

Conclusion

The major haematological changes observed were Leukopenia, thrombocytopenia, anaemia and the major biochemical changes recorded were increased AST and creatinine, hypoproteinaemia and hypoalbuminemia in cats affected with FPL in comparison with healthy cats.

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