

## Status of hemato-biochemical parameters in feline infectious peritonitis (FIP) affected cats

### Abstract

Feline infectious peritonitis (FIP) is a serious viral disease of cats that usually results in death. There is derangement of vitals in cats due to FIP including clinical and hemato-biochemical parameters. This study reports some findings in a group of six cats (3 Persian, 2 mixed breed, 1 nondescript) affected with FIP. Cats were diagnosed on clinical signs, FIP rapid test, Rivalta test, USG and X-ray. Ground glass appearance of abdomen on X-ray, hyperechogenicity of liver and loss of renal/cortical texture on ultrasonography (USG) was noted. Among the liver function tests, alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were  $76.2400 \pm 4.35373$  and  $58.6333 \pm 13.75860$  IU/L, respectively. Kidney function tests including bilirubin, blood urea nitrogen (BUN) and creatinine were  $3.533 \pm 0.4601$ ,  $62.5000 \pm 2.45967$  and  $2.8833 \pm 0.48402$  mg/dl, respectively. Hematological values including Hb ( $10.4500 \pm 0.76714$ ), RBC ( $7.4400 \pm 0.78636$ ), PCV ( $26.7667 \pm 3.59042$ ), WBC ( $18.2850 \pm 2.72594 \times 10^3/\mu\text{l}$ ), granulocytes ( $15.3167 \pm 2.84762\%$ ), lymphocytes ( $1.7000 \pm 0.34351\%$ ) and platelets ( $310.8333 \pm 75.50074$ ) showed derangement. This study establishes baseline data for FIP cases in this region and can serve as a basis of prognosis of FIP based on clinical and hematobiochemical parameters.

### Introduction

Feline infectious peritonitis (FIP) is one of the most important viral infectious disease of cats caused by feline infectious peritonitis virus (FIPV) strains of feline coronavirus (FCoV) (Paltrinieri et al., 2021; Yousuf et al., 2022). It is a severe immune mediated disease characterised by effusion and pyogranulomatous inflammation (Ziółkowska et al., 2017). It causes inflammatory cascade and affects multiple organs including liver, kidney, heart, brain and involves structures or body cavities also like peritoneum (Malbon et al., 2019) thus resulting in wet or effusive form and dry or noneffusive form of disease (Ziółkowska et al., 2017). Clinical signs range from simple fever, anorexia, depression, dullness, weakness, loss of body condition, abdominal distension, to complex ocular deformities and neurological abnormalities (Yousuf et al., 2022; Tasker et al., 2023). Diagnosis is based on clinical signs, effusion analysis, haemato-biochemical, serological, molecular and histological tests (Felten et al., 2019). Though there is

evidence of FIP in cats in this part of the world however there is lack of study on diagnostic and hemato-biochemical aspects of FIP in cats.

### **Materials and methods**

This study was conducted at Veterinary Clinical Complex Faculty of Veterinary Sciences and Animal Husbandry Shuhama. A total of six cats (3 Persian, 2 mix breed, 1 nondescript), in the age group of 1-3 years, were diagnosed based on clinical signs, FIP Rapid test kit, Rivalta test, abdominal USG and X-ray. Blood samples were collected in EDTA vials (0.2 ml) for haematology and clot activator vials (0.8 ml) for biochemical analysis after extracting serum. Hematological analysis was done by automatic veterinary haematology analyser (Nihon Kohden, Celltac alpha MEK-6550) and for biochemical analysis; liver function tests (ALT and AST) and kidney function tests (bilirubin, BUN and creatinine) were done by spectrophotometric assays using kits purchased from Meril India.

### **Results**

Cats revealed clinical signs of FIP including abdominal distension (3) (Figure 1), lethargy, inappetance, intermittent fever, dullness, weakness (6), pale mucous membrane (2), jaundice/icterus (3) and ocular (2) signs. None had neurological signs. Peritoneal fluid from affected cats with abdominal distension (3) showed positive Rivalta test. Five out of six suspected cats were positive on rapid FIP test. Ground glass appearance of abdomen on X-ray in cats having abdominal distension and hyperechogenicity of liver and loss of renal/cortical texture on USG was pointed out.

Haematological values including Hb ( $10.4500 \pm 0.76714$ ), RBC ( $7.4400 \pm 0.78636$ ), PCV ( $26.7667 \pm 3.59042$ ), WBC ( $18.2850 \pm 2.72594 \times 10^3/\mu\text{l}$ ), granulocytes ( $15.3167 \pm 2.84762\%$ ), lymphocytes ( $1.7000 \pm 0.34351\%$ ) and platelets ( $310.8333 \pm 75.50074$ ) showed derangement. Among the liver function tests, ALT and AST were  $76.2400 \pm 4.35373$  and  $58.6333 \pm 13.75860$  IU/L, respectively. Kidney function tests including bilirubin ( $3.533 \pm 0.4601$ ), BUN and creatinine were  $62.5000 \pm 2.45967$  and  $2.8833 \pm 0.48402$  mg/dl, respectively.

### **Discussion**

FIP is a multisystemic disease caused by feline infectious peritonitis virus (FIPV) strains of feline coronavirus (FCoV) (Paltrinieri et al., 2021; Yousuf et al., 2022). It affects various organs or structures thus producing a conglomerate of clinical signs (Hartmann 2005; Yousuf et al., 2022). The clinical signs of fever, fluid exudation and distension, loss of body condition, dullness

and weakness noted in our findings may be due to inflammatory reactions or perivascular phlebitis induced by FIPV that can affect any organ. These signs are located in corroboration with Malbon et al. (2019) and Tasker et al. (2023).

Diagnosis by Rivalta test and rapid FIP test is routine in clinical practice. High sensitivity has been detected with Rivalta's test which is usually performed for the effusive fluid during the clinical diagnosis of wet FIP cases (Felten and Hartman 2019). It is under a sensitivity of 91.3% and specificity of 65.5% (Fischer et al., 2012). We also stressed 100% positive test rate in affected cats with abdominal distension. FIP Rapid tests are frequently used in diagnosing affected cats (Felten and Hartmann 2019; Vojtkovská et al., 2022). They detect antigen or antibody in samples and help in rapid diagnosis besides being simple and cheap. They have excellent sensitivity and specificity. We have noted a positivity of 83.33% (5/6). Vojtkovská et al. (2022) have also evaluated various rapid tests for FIP and found a sensitivity of 90 to 95% and specificity of 95% versus PCR test.

In FIP affected cats haematological and biochemical disturbances occur due to effects of virus and inflammatory reactions on various organs and systems. Haematological values RBC, Hb and PCV were lower and WBC, TLC and N were higher in affected cats indicating anaemia and inflammatory response to infection. Yin et al. (2021) are further conducted haematological tests in their study which showed similar values in FIP affected cats. Our findings of lower RBC, higher WBC, N and lower L in FIP cats are in corroboration with Paltrinieri et al. (2002). Anaemia, leucocytosis, neutophilia and lymphopenia are routine findings in FIP affected cats which is also reported by Anwer et al. (2022) and Tsai et al. (2011). Anaemia may be due to adverse effect on hematopoietic system, nutritional deficiency due to inappetance or anorexia, or damage to RBCs. Leucocytosis may be caused by inflammatory response to viral or secondary bacterial infection.

Elevated LFT and KFT parameters may be caused by liver and kidney damage. This is consistent with findings of Anwer et al. (2022) and Tsai et al. (2011) who have also reported elevated AST, ALT, bilirubin, creatinine and BUN in FIP cats. Sase (2023) has reported elevated AST in FIP cats. FIPV damages hepatic and renal parenchymal texture as is further evidenced on USG. Inflammatory exudation or perivascular phlebitis leads to fluid accumulation in abdominal cavity giving ground glass appearance on X-ray. This has also been found by Anwer et al. (2022) and Zoia et al. (2009).

## Conclusion

This study revealed derangement of clinical, hematological and biochemical parameters in FIP affected cats. Clinical signs can be correlated to effects of inflammatory cascade resulting in fever, dullness, inappetance, lethargy, abdominal distension or recumbency and further progressing to multiorgan damage. Clinical signs, Rivalta test and rapid antigen tests can be useful in diagnosing FIP. These are very easy and cheap but not confirmatory however for confirmation histopathology, RT-PCR or more relevant tests are needed. Their cost and involvement of sophisticated infrastructure render them inconvenient. Diagnostic imaging can be a supportive diagnostic option wherever available.

FIPV affects various organs and organ systems. Decreased values of haematological values may be due to anaemia resulting from liver damage and nutrient deficiency due to less feed intake. Elevated WBC may indicate response to inflammatory reaction or secondary bacterial infection. Increased values of LFT and KFT indicate liver and kidney damage.

Thus this can be concluded from this study that the clinical, biochemical and haematological values can reflect a state of derangement of vital parameters or organ functions and can have diagnostic and prognostic role in FIP cases.

**Table 1. Status of biochemical and haematological values (Mean±SE) in FIP affected cats.**

| Parameter                  | N         | Minimum   | Maximum   | Mean±SE |            |
|----------------------------|-----------|-----------|-----------|---------|------------|
|                            | Statistic | Statistic | Statistic | Mean    | Std. Error |
| ALT (U/L)                  | 6         | 60.99     | 89.07     | 76.2400 | 4.35373    |
| AST (U/L)                  | 6         | 0.00      | 88.05     | 58.6333 | 13.75860   |
| WBC ( $10^3/\mu\text{l}$ ) | 6         | 7.01      | 25.90     | 18.2850 | 2.72594    |
| RBC ( $10^6/\mu\text{l}$ ) | 6         | 5.07      | 10.20     | 7.4400  | 0.78636    |
| Hb (mg/dl)                 | 6         | 7.30      | 12.30     | 10.4500 | 0.76714    |
| PCV (%)                    | 6         | 14.50     | 36.80     | 26.7667 | 3.59042    |
| L ( $10^3/\mu\text{l}$ )   | 6         | 0.70      | 2.70      | 1.7000  | 0.34351    |
| M ( $10^3/\mu\text{l}$ )   | 6         | 0.10      | .40       | 0.2667  | 0.04216    |
| E ( $10^3/\mu\text{l}$ )   | 6         | 0.30      | 1.50      | 1.0333  | 0.20602    |
| G ( $10^3/\mu\text{l}$ )   | 6         | 3.90      | 23.50     | 15.3167 | 2.84762    |
| PLT ( $10^6/\mu\text{l}$ ) | 6         | 0.83      | 5.4       | 3.108   | 0.755      |
| BUN (mg/dl)                | 6         | 55.00     | 70.00     | 62.5000 | 2.45967    |
| Creatinine (mg/dl)         | 6         | 1.90      | 5.00      | 2.8833  | 0.48402    |
| Bilirubin (mg/dl)          | 6         | 2.5       | 5.6       | 3.533   | 0.46019    |



**Fig.1. Abdominal distension in a FIP affected cat**



**Fig.2. Ground glass appearance in FIP affected cat**

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