A Successful Recovery of a Cat Affected with Feline Infectious Peritonitis Virus at a private clinic in Mirpur, Dhaka : A Case Report

Clinical Report Submitted

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List of Abbreviation

FCoV: Feline Corona Virus

FIP: Feline Infectious Peritonitis

ALT: Alanine Aminotransferase

AST: Aspartate Aminotransferase

ALP: Alkaline Phosphatase

Abstract

The virus that causes Feline Infectious Peritonitis (FIP), can infect both domestic and wild cats. A 1.5 years old domestic female short haired mix breed cat named Mekasa, weighing 3.4 kg, arrived at the Mirpur Pet Animal Clinic, Mirpur, Dhaka, with a history of off feeding, simultaneous high fever, lacrimation, depressed, conjunctivitis and weight loss. After observing the 107.4° Fahrenheit temperature of the cat, Alkaline phosphatase (ALP), SGPT, SGOT, Bilirubin, BUN, Serum creatinine, Total protein (TP), and Albumin parameter of blood were assessed following the patient's blood sample collection. The patient's kidney, chest, and abdominal anatomy were examined using an X-ray and an ultrasound. Observing the clinical history, clinical signs, ratio of Albumin & Globulin and the result of FIP rapid kit test, it was confirmed that the cat was affected with dry form of Feline Infectious Peritonitis. FIP is also known as Feline corona and it has always been considered as a fatal illness. Though FIP is not a zoonotic diseases but the prevalence of Feline corona virus was widely spread after the pandemic of COVID-19 in human. But it is a matter of happiness that, the scientists have been more interested in the pathophysiology and possible treatments of coronaviruses because of the recent COVID-19 pandemic. For this reason, now we can have the opportunity to cure the FIP patient. Mekasa, the 1.5 year cat was successfully cured by the daily infusion of the drug GS-441524 (the main plasma metabolite of the antiviral prodrug Remdesivir) for 84 days at Mirpur Pet Animal Clinic, Dhaka.

Keywords: simultaneous fever, FIP rapid kit test, A-G ratio, dry form, COVID-19, GS-441524

Introduction

The family Coronaviridae includes the significant group of viruses known as feline coronaviruses (FCoV). Diseases including Covid-19 in human, Feline Infectious Peritonitis in cats, gastroenteritis in dogs, and Infectious Bronchitis in poultry can be caused by this family's ability to infect a wide range of animals (Sifa-Shaida et al., 2020). Because of its high potential for mutation, when it does happen, treating the host becomes challenging. According to studies on the epidemiology of FIP, the majority of cases (75%) happen in families with several cats, and the disease is most prevalent in young cats (between three months and three years) (Pesteanu-Somogyi et al., 2006).

A mutated variant of the feline coronavirus (FCoV) causes feline infectious peritonitis, or FIP, a fatal disease that attacks the entire body (Vennema et al., 1998). The illness, which was not recognized until the 1950s (Holzworth, 1963), is characterized by an inflammation that is linked to vasculitis and can range from perivascular granulomatous to pyogranulomatous (Kipar et al., 2005). Both the "wet" and "dry" forms of feline infectious peritonitis can appear in a clinical environment, while some cats may have symptoms that combine the two (Hartmann, 2005). Ocular and neuro form involvement frequently arises in the so-called "dry" form of the illness (Tsai et al., 2011).

The earliest description of FIP's ocular symptoms was given by (Doherty, 1971). These symptoms include keratic precipitates, exudative retinal detachment, perivascular cuffing of retinal arteries, pyogranulomatous pan uveitis with fibrinous exudate in the anterior chamber, and optic neuritis. The first person to describe the ocular symptoms of FIP was Doherty. The body of veterinary literature only describes three instances of dermatological abnormalities occurring in association with spontaneous FIP (Cannon et al., 2005; Declercq et al., 2008; Gross, 1999). This suggests that these circumstances are quite rare. Clinical lesions that have been previously documented include papular lesions over (Gross, 1999), small nodules over the neck and proximal forelimbs that are characterized by pyogranulomatous phlebitis in a cat with concurrent feline corona virus

(FCoV) infection, and truncal papules to nodules that are characterized by pyogranulomatous vasculitis and folliculitis.

The diagnosis of FIP is challenging, and in most cases, it can also be challenging to make an antemortem diagnosis, especially in non-effusive and "dry" patients (Pedersen, 2009). It is considered the gold standard to evaluate biopsy or necropsy material histopathologically. To further confirm the sickness, immunohistochemistry (IHC), which identifies intracellular FCoV antigens in macrophages, is frequently required (Addie et al., 2004; Giori et al., 2011; Hartmann, 2005; Pedersen, 2009).

Feline infectious peritonitis is an illness that is frequently misdiagnosed. Its nebulous general clinical signs are frequently observed. These symptoms include lethargy, anorexia, weight loss, and a persistent fever. Anemia, lymphopenia, neutrophilia, hyperproteinemia, and hypergammaglobulinemia are a few examples of clinicopathologic abnormalities in FIP that do not function as pathognomonic indications (Paltrinieri et al., 2001). A cat that has received the FPV vaccine is said to be less prone to FIP. Based on strong immunostaining for intracellular FCoV in many skin lesions in the diseased animal, we present an antemortem diagnosis of feline infectious peritonitis (FIP) in a Sphinx cat with bilateral pan uveitis.

Materials and Methods

2.1. Study Period & Area: The study period was in between July 2024 to October 2024. It was conducted in a renowned pet clinic at Mirpur (Fig. 1) named Mirpur Pet Animal Clinic. It is located in between 23.8283° north latitudes and 90.3607° east longitudes. The clinic has diagnostic facilities like x-ray, ultrasound, skins scraping test, rapid kit test, laboratory test, biochemical tests and so on. Besides, It features vaccination, deworming, health check, treatment and surgery are just a few of the services provided for both birds and the animals who share our homes.

Figure-1: Map of study area (Pallabi, Mirpur)

2.2. Clinical History: A female domestic short haired mixed breed cat of Tanisha Islam of 1 year six months aged with 3.4 kg body weight named Mekasa was brought to Mirpur Pet Animal Clinic with a complaint of simultaneous high fever for 3-4 days from Mirpur DOHS, Dhaka. Other history was off feeding, lacrimation, depressed, conjunctivitis and weight loss and recently recovered from FPV and it was a non-vaccinated cat.

2.3. Clinical Signs: The clinical observation of Mekasa was taken as follows. Temperature (Fig. 2) was 107.4° Fahrenheit (Horhogea et al., 2011), m/m was slight pale, dry tongue, yellowish ear, mild dehydration, yellowish color urine and smells like jerky and a respiration rate of 30 breaths per minute as well as a heart rate of 140 beats per minute.

Figure-2: Clinical examination of the patient

2.4. Sample Collection: To confirm the presence of FIP virus, 1 ml blood as blood samples were collected from right femoral vein using a 23 gauze butterfly needle connected with a 3 ml syringe and immediately transferred it to a vacutainers which was not include anticoagulants (Fig. 3). The sample was then used for the further tests.

Figure-3: Blood collection for Tests

2.5. Laboratory Investigation of Blood: For conducting the biochemical test, anticoagulant-free blood was kept in a rack for 5 mins so that it can clot. After that, the blood kept in a centrifuge machine at 2000 rpm for 10 mins. The serum and the supernatant were then suitably separated.

After that, The biochemical test was performed using the Humalyzer 3000 in accordance with the manufacturer's instructions and the prescribed protocol. Table 1 shows the results of the blood biochemical analysis, which indicate that while the albumin level (2.03 gm/dl) is below the reference value, the total protein level (5.74 gm/dl) is higher. Furthermore, the levels of TP and albumin were used to calculate the value of globulin. The blood's globulin level was found to be 3.71 gm/dl. It was found that the bilirubin level was 3.1, the SGPT level was 54.4, and the SGOT level was 48. The level of ALP was determined as 23.7 which was within the normal range. The sample's albumin to globulin ratio was 0.54 which indicates a positive FIP result (Pedersen, 2014).

Table 1: Biochemical parameters of blood serum (before treatment)

Parameters	**Reference value**	**Test value**	**Remarks**
Total protein	5.2-8.8 (gm/dl)	5.74 (gm/dl)	N
Albumin	2.5-3.9 (gm/dl)	2.03 (gm/dl)	L
Globulin	2.3-5.3 (gm/dl)	3.71 (gm/dl)	N
Bilirubin	0.1-0.4 (mg/dl)	3.1 (mg/dl)	H
AIT/SGPT	10-100 (u/l)	54.4 (u/l)	N
AST/SGOT	10-100 (u/l)	48 (u/l)	N
ALP	10-50 (u/l)	23.7 (u/l)	N

2.6. Radiological tests: An ultrasound of the ventral lower abdomen was done in order to get data on the anatomy of both kidneys and the abdomen. To prepare for this treatment, the cat was aided by shaving its ventral lower belly with a disposable razor. In order to assess the internal condition of the abdomen and identify the cortex of both kidneys, an ultrasonic probe was positioned on the ventral lower abdomen of the cat after it had been properly secured. This was accomplished by ultrasonography. At a frequency of 4.0MHz and 15A, the USG process was made.

To find out how the disease affected the chest and abdomen, an X-ray was also obtained. Once the animal was fastened, it was placed on its side and exposed to the light in both a ventral and lateral position so that pictures of the chest and abdomen could be taken.

If the body cavity included with fluid, this would be regarded as an effusive or wet FIP (Pedersen, 2009).

2.7. Feline Infectious Peritonitis Antibody Rapid Kit Test (FIP Ab): The fastest and most reliable method for determining whether a cat has feline infectious peritonitis (FIP) is the FIP Ab rapid test. The FIP Ab quick test kit was used to confirm the presence of FIP in cats using a test cassette. It was necessary to let the blood samples and all of the kit's components (Testsealabs) to get to room temperature before beginning any testing. One drop of serum was then added to the sample well after a thirty to sixty second pause. Within fifteen to tewnty minutes of adding three drops of buffer to the kit well, the result can be read. In that case, the test kit's result was positive by observing both the Control line (C) and Test line (T) in the kit (Fig. 4).

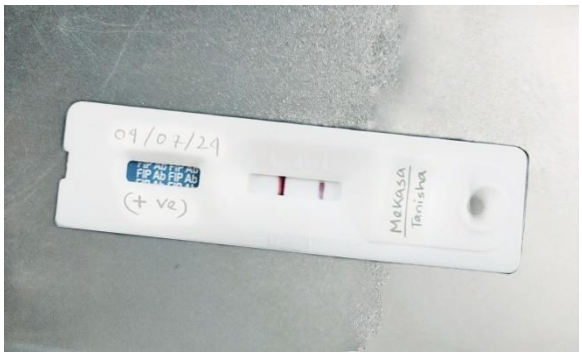

Figure-4: FIP Ab Rapid Test (Positive)

2.8. Treatments: An antiviral drug was administered named Inj. GS-441524 (Gilead Sciences, the main plasma metabolite of the antiviral prodrug Remdesivir) of 6 ml vial, @ 1.7 ml medicine as 0.5 ml / kg body weight, was infused at subcutaneous route, daily for 84 days. An antibiotic was administered to avoid the secondary bacterial growth which was Cap. Doxin – 100mg, Opsonin Pharma Ltd. (Doxycycline – 5mg/kg body weight) as 1 capsule mixed with 4 ml drinking water and feed 3 ml orally twice a day for 14 days. An steroidal anti-inflammatory medicine named Tab. Decason 0.5 mg

(Dexamethasone) of Opsonin Pharma Ltd, was administered orally in the dose of 1 tablet, twice daily for 1st 7 days and repeat the same dose but once daily for next 7 days. Additionally, Syp. Famotack 50 ml (Famotidine) of Square Pharmaceuticals Ltd. was prescribed as 1 ml orally before diet twice a day for 14 days. An important vitamin supplement, Inj. Cynovit 1 ml (Cyanocobalamin) of Chemist Pharma Ltd was inject intramuscularly, at 0.35 ml, once in a week for 5 dose. As the Bilirubin level was higher than normal, Syp. Liv. 52 (Liver tonic) was suggested at 1.5 ml, orally, twice daily for 30 days for the betterment of the liver of Mekasa.

Results and Discussion

In order to diagnose FIP, clinical indications and symptoms are necessary in addition to diagnostic assistance because the premortem diagnosis of FIP might be challenging.

The biochemical features of the patient's blood are a major factor in the diagnosis of FIP. The biochemical test findings for the blood in this case revealed lower-than-expected albumin levels and higher levels of total protein, bilirubin, SGPT, and SGOT (Table 1). A common outcome in the total serum protein concentration is a typical outcome in the FIP laboratory (Paltrinieri et al., 2002). The primary cause of this concentration increase is an increase in gamma globulins. An increase in bilirubin and liver enzymes may occur, but this does not necessarily aid in diagnosis. This is due to the fact that it is dependent upon both the location and the degree of organ damage. Feline infectious peritonitis (FIP) should be more likely when there is decreased liver enzyme activity and high bilirubin levels without hemolysis (Hartmann, 2005).

The ratio of albumin to globulin was 0.54, which was another important finding from this study. As a diagnostic tool, the albumin-globulin ratio is more useful than the gamma globulin or total blood protein concentrations. Because albumin and globulin levels will decrease simultaneously if the liver is damaged, this is the cause (Rohrer et al., 1993). It is believed that protein loss from glomerulopathy generated by the immune complex or the extravasation of fluid rich in proteins during vasculitis often coexists with low albumin. It is believed that both of these mechanisms are connected to vasculitis (Hayashi et al., 1982). There is a high probability that the cat has feline infectious peritonitis (FIP) if the serum albumin to globulin ratio is less than 0.8.

One crucial piece of equipment for diagnosing FIP is the FIP Ab fast kit test. It is unlikely that normally healthy cats with negative antibody test results are FCoV execrators or carriers. The Rapid FIP kit test is the screening method utilized for the precise detection of FCoV antibodies in the cat's whole blood, plasma, serum, and effusion because it is based on highly specific and recombinant FCoV antigens. There are

two distinct lines of information on the test cassette. The test line is the second line, and the control line is the first. Regardless of the T line's clarity or haziness, the existence of both lines within 20 minutes of one another indicates the presence of FIP. The test is regarded as negative (TESTSEALABS) if there is only a C line (Soma & Ishii, 2004).

The CBC (complete blood count) was one procedure that was impossible to perform due to the specifics of this instance. Normocytic, normochromic, non-regenerative anemia, neutrophilic leukocytosis with lymphopenia, eosinopenia, and monocytosis are among the CBC abnormalities observed in cats infected with FIP (Diaz & Poma, 2009).

A feline enteric coronavirus biotype that has been modified causes feline infectious peritonitis, commonly referred to as influenza. The FIP virus that is subsequently generated in cases of non-effusive illness is known to commonly cause harm to the eyes and central nervous system (CNS). In spite of the numerous treatments that have been created over the years, more than 95% of cats with FIP will pass away within a few days to months of being diagnosed. Recent antiviral medications have demonstrated promise in treating neurological FIP; nevertheless, there is a lack of data from patients with neurological FIP (Dickinson et al., 2020).

In order to produce exceptional results in the treatment of non-effusive or wet FIP at Mirpur Pet Animal Clinic, GS-441524, the prodrug of Remdesivir, was given subcutaneously once daily for 84 days at a dose of 5–10 milligrams per kilogram of body weight (Bohm, 2022). The initial doses of Remdesivir should be administered intravenously with a saline solution (Ringer's lactate solution) if the animal is very dehydrated. Doxycycline was prescribed as an oral antibiotic to be taken twice daily for 10 days at a dosage of 5 milligrams per kilogram of body weight in order to prevent pleasant respiratory symptoms and a subsequent bacterial infection (Bacek & Macintire, 2011; Dunowska & Ghosh, 2021).

Dexamethasone, a steroidal anti-inflammatory drug, was administered orally twice daily for the first seven days and once daily for the final seven days to treat recurrent fever (Addie et al., 2020; Ishida et al., 2004). The dosage was 0.5 milligrams per kilogram of the patient's body weight. For 14 days, an oral antacid, such as famotidine, was

administered at a dosage of 4 milligrams per kilogram of body weight before to each meal as a supportive and symptomatic treatment (Marks, 2016; Meazzi et al., 2019). Furthermore, five doses of cyanocobalamin (Vitamin B12) were administered subcutaneously once a week at a dosage of 50 milligrams per kilogram of body weight (Jones et al., 2021; Winzelberg Olson & Hohenhaus, 2019)

3.1. Follow Up and Outcome: For a total of eighty-four days in a row, the cat was given a treatment with Inj. GS-441524 (main plasma metabolite of the antiviral prodrug Remdesivir) of 6 ml vial, @ 1.7 ml medicine as 0.5 ml / kg body weight. She did not receive any additional antiviral treatment throughout this time. Mekasa had a noticeable improvement in her health and a decreased risk of illness in just fourteen days. She was more active, her appetite had returned to normal after going from insatiable to normal, and her cat appeared to be functioning like a typical cat after a month of treatment, according to her owner. The injection was painless, and there were no noticeable side effects at the injection site. Over time, he gained muscle bulk and enhanced his coat. She weighed 4.6 kg at the follow-up examination three months after treatment started, had a body condition score of 3.5 out of 5, a slightly fast heartbeat, a normal respiration rate, normal muscle tone, an x-ray, formed lordosis in the thoracic region, and a hematological value that was better than normal in comparison to the previous examination (Table 2).

Figure-5: FIP Ab Rapid Test (Negative)

Apart from the FIP Ab fast test result being negative (Figure 5), a clinical examination did not show any other abnormalities. His symptoms were still absent at the time of writing, and he had discontinued therapy five months prior.

The results of the blood biochemical examination showed that the albumin level was 3.5 gm/dl and the total protein level was 7.1 gm/dl, as shown in Table 2. Additionally, the findings of the TP and albumin computations were combined to determine the value of globulin.

Table 2: Biochemical parameters of blood serum (after treatment)

Parameters	**Reference value**	**Test value**	**Remarks**
Total protein	5.2-8.8 (gm/dl)	7.1 (gm/dl)	N
Albumin	2.5-3.9 (gm/dl)	3.5 (gm/dl)	N
Globulin	2.3-5.3 (gm/dl)	3.6 (gm/dl)	N
Bilirubin	0.1-0.4 (mg/dl)	0.3 (mg/dl)	N
AIT/SGPT	10-100 (u/l)	97 (u/l)	N
AST/SGOT	10-100 (u/l)	54 (u/l)	N
ALP	10-50 (u/l)	36 (u/l)	N

The results of the blood biochemical examination showed that the albumin level was 3.5 gm/dl and the total protein level was 7.1 gm/dl, as shown in Table 2. Additionally, the findings of the TP and albumin computations were combined to determine the value of globulin. It was found that the blood contained 3.6 gm/dl of globulin overall. The sample's albumin-globulin ratio was 0.97, which strongly suggests that it is negative for FIP. The proportion of albumin to globulin is shown by this ratio. While the SGPT and SGOT levels were 97 and 54, respectively, the bilirubin level was revealed to be 0.3. Both figures are significantly greater than the bilirubin level. The ALP level was found to be 46, which was within the typical range.

Conclusion

As the index of FIP suspicion rises, the physician must begin integrating diagnostic tests that will aid and guide them toward a more conclusive diagnosis. In addition to assessing the diagnostic test's sensitivity and specificity, it's critical to consider its limitations. Researchers discovered that giving remdesivir subcutaneously for 84 days at a dose of 10 mg/kg was necessary to stop FCoV shedding in cats that were naturally infected. This treatment may help create cat homes free of FCoV in addition to current cleaning practices, group cat housing, and the use of virus-inhibiting cat litter.

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Biography of Author

The Author Mohibbur Rahman, from Feni sadar, Feni. The son of Mojibur Rahman and Jobeda Akter, completed his S.S.C. examination in 2016 and in 2018, accomplished his H.S.C. examination. In the academic year of 2018-19, he got admitted in Chattogram Veterinary and Animal Sciences University into the Faculty of Veterinary Medicine in order to achieve the DVM (Doctor of Veterinary Medicine) degree. The author wants to devote the rest of his life as a future veterinarian to the welfare of animals. He also eager to work as a competent pet practitioner and field veterinarian.