

Administration of Remdesivir for the Treatment of Feline Infectious Peritonitis – A Case report



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Table of Contents

Contents	Pages
Statement of Author.....	IV
List of Tables.....	V
List of Abbreviation.....	V
Abstract.....	VI
1. Introduction.....	1
2. Materials and Methods	
2.1 Study area.....	4
2.2 Clinical History.....	4
2.3 Clinical Sign.....	4
2.4. Sample Collection.....	4
2.5. Laboratory Investigation of Blood.....	5
2.6. Radiological tests.....	5
2.7. Feline Infectious Peritonitis Antibody Rapid Test (FIP).....	5
2.8. Treatments.....	6
3. Results.....	7
4. Discussion.....	9
5. Conclusion.....	11
References.....	12
Acknowledgment.....	15
Biography of the author.....	16

Statement of Author

I, Nayeem-Been-Zaman, certify unequivocally that I have performed all the tasks detailed in this report. The data was gathered from books, national and international periodicals, and other sources. All citations have been properly acknowledged. Consequently, I am solely responsible for collecting, manipulating, preserving, and publishing all data compiled in this report.

The Author

List of Tables

Table 1 Biochemical parameters of blood serum	7
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Table 2 Biochemical parameters of blood serum (after treatment)	8
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List of Abbreviation

CVASU	Chattogram Veterinary and Animal Sciences University
TTPHRC	Teaching and Training Pet Hospital and Research Center
FCoV	Feline Corona Virus
FIP	Feline Infectious Peritonitis
ALT	Alanine Aminotransferase
AST	Aspartate Aminotransferase
ALP	Alkaline Phosphatase

Abstract

Feline Infectious Peritonitis or FIP, is a life-threatening viral disease that can infect both domestic and wild cats. Mini, a 2 years 1 months old domestic female shorthair crossbreed cat weighing 3.2 kilograms, presented to the Teaching and Training Pet Hospital and Research Center (TTPHRC) in Purbachal, Dhaka, with a history of stress, lacrimation, conjunctivitis, anorexia, weight loss, and persistent fever. The patient was evaluated for following parameters: total protein (TP), albumin, bilirubin, SGPT, SGOT, and alkaline phosphatase (ALP). The patient's kidney, chest, and abdominal structures were examined with an X-ray and ultrasound. Based on the clinical history and symptoms, it was assumed that the cat had non-effusive feline infectious peritonitis which was confirmed by testing positive for FIP Ab rapid test and having low serum total protein and albumin-globulin (A-G) ratio. Remdesivir (10 mg/kg body weight daily for 84 days) was a successful treatment option for this cat. The patient successfully recovered and physically improved with better health after the completion of treatment.

Keywords: persistent fever, FIP Ab rapid test, A-G ratio, remdesivir

Chapter 1: Introduction

Feline infectious peritonitis (FIP) is a coronaviral disease that can afflict cats of any age. But it is more common in cats aged 3 to 16 months (Pedersen, 2009). FIP's incidence varies greatly over time, as is typical of an enzootic illness. Once clinical indications develop, the mortality rate is exceedingly high, while some cats can live with the condition for weeks, months, or, in rare cases, years (Addie et al, 2009). Feline coronavirus (FCoV) is a large group of viruses in the Coronaviridae family. This family of virus can infect a wide range of hosts, causing diseases such as Covid-19 in people, feline infectious peritonitis in cats, gastroenteritis in dogs, and infectious bronchitis in chickens (Sifa-Shaida et al., 2020). It has a high mutation rate, making it difficult to treat the host when it does occur.

Previous studies revealed that this disease is most common in young cats (three months to three years) and that the majority of cases (75%) occur in families with many cats (Pesteanu-Somogyi et al., 2006). FIP virus (FIPV) is caused by particular mutations in a common feline enteric coronavirus (FECV), which is found in cats all over the world but is not a significant pathogen in and of itself (Pedersen, 2009). In large multi-cat situations, FECV is shed in the feces of most apparently healthy cats (Pedersen et al., 2004), and transmission occurs through direct ingestion of feces or contaminated litter and other fomites. Kittens are often infected at 9 weeks of age (Pedersen et al, 2004, Pedersen et al, 2008). FECV mutants capable of producing FIP are most likely produced in huge numbers during the initial infection, when FECV replication levels are extraordinarily high (Pedersen et al, 2008; Vogel et al, 2010). The interval between initial FECV exposure and clinical indications of disease might range from 2-3 weeks to several months or, in exceptional cases, years. This time frame could represent the time required for mutant FIPVs to evolve or for the disease to progress from a subclinical to a symptomatic stage. Subclinical infections are typically restricted to the mesenteric lymph nodes and can resolve or progress (Legendre et al., 2009).

Feline infectious peritonitis (FIP) is a fatal sickness that affects the entire body and is caused by a modified form of the feline coronavirus (FCoV) (Vennema et al., 1998). In a clinical environment, feline infectious peritonitis can present as "wet" or "dry"; however, some cats may exhibit symptoms that are a combination of the two (Hartmann, 2005). Ocular involvement is common in the "dry" version of the sickness (Tsai et al., 2011).

Owners who have recently bought a kitten or young cat are frequently profoundly bonded to the animal before the first signs of FIP appear. The diagnosis of FIP, particularly given its high mortality rate and lack of effective therapy, has a significant psychological impact on many owners. It is also the most dreaded trigger for owner communication by both breeders and shelter managers. Owners may be hesitant to accept the diagnosis or the news that there is no effective therapy because some cats with FIP are still relatively healthy at the time of diagnosis and can sometimes live weeks or months longer with only symptomatic treatment.

FIP is difficult to identify, and in most circumstances, an antemortem diagnosis of FIP may be challenging as well, particularly in non-effusive and 'dry' cases (Pedersen, 2009). The gold standard test is histopathologic assessment of biopsy or necropsy samples. Furthermore, immunohistochemistry (IHC), which involves identifying intracellular FCoV antigens in macrophages, is frequently required to confirm the sickness (Giori et al., 2011). The Rapid FIP test is the screening tool used to accurately identify 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 control line appears on the first line, while the test line appears on the second. Regardless of the clarity or haziness of the data, the existence of both lines within ten minutes of one another indicates the presence of FIP. According to TESTSEALABS, the test is deemed unsuccessful if there is only a C line (Soma & Ishii, 2004).

Over 95% of cats with FIP will pass away from the condition within days to months following a diagnosis, despite the numerous treatments that have been discovered over

the years (Dickinson et al., 2020). Although there is a lack of data from neurological FIP patients, recent antiviral medications have demonstrated promise in the treatment of neurological FIP (Dickinson et al., 2020). Although FIP is the most fatal and prevalent disease of cats, very few research on FIP were performed in Bangladesh. Hence the current study will show that if the FIP infected cat can be properly diagnosed and may receive the remdesvir drug on time then the chances of recovery will increase.

Chapter 2: Material and Methods

2.1. Study Area

The Teaching and Training Pet Hospital and Research Centre (TTPHRC), affiliated with Chattogram Veterinary and Animal Sciences University (CVASU), is currently located in the Purbachal suburb of Dhaka.

2.2. Clinical History

A 3.2 kilogram and 2 year one months age of female domestic shorthair cross breed cat from Mirpur, Dhaka, was carried to the Teaching and Training Pet Hospital and Research Center due to a respiratory problem. Additional medical history included weight loss, anorexia, and recurrent fever. The patient was visited by several veterinarians before coming to TTPHRC, Purbachal, Dhaka.

2.3. Clinical Signs

Clinical indications of anorexia, tachycardia, and mild dehydration were present when the patient was admitted to the hospital. The parameters were as follows: a heart rate of 160 beats per minute, a respiratory rate of 40 breaths per minute, and a body temperature that fluctuated between 102.4 degrees Fahrenheit.

2.4. Sample Collection

Blood samples were collected from the right cephalic vein using a 23-gauge butterfly needle and a 3-milliliter syringe to assess the presence of FIP. The samples were then put into vacutainers devoid of anticoagulants. After that, total protein (TP), albumin, and globulin were analyzed using these.

2.5. Laboratory Investigation of Blood

Anticoagulant-free blood was inverted and allowed to coagulate at an angle for thirty minutes in order to perform a biochemical test. Following that, the serum and supernatant were correctly separated.

Subsequently, the biochemical test was conducted by the HumaLyzer 3000 according to the manufacturer's guidelines and the prescribed protocol.

2.6. Radiological tests

An ultrasound scan of the ventral lower abdomen was done in order to learn more about the internal structure of the abdomen and both kidneys. After proper preparation and sedation, an ultrasonic probe was applied to its ventral lower abdomen to identify the kidney's cortex on both sides and assess the abdomen's interior condition. The USG process was carried out at 15A and 4.0MHz in frequency.

Furthermore, an X-ray was obtained to assess the impact of the on the chest and abdomen sickness. Once the animal was safely fastened, it was flipped onto its side and positioned beneath the light source in both a ventral and lateral orientation to capture images of its abdomen and chest.

2.7. Feline Infectious Peritonitis Antibody Rapid Test (FIP Ab)

Using the FIP Ab quick test kit, a test cassette was used to confirm the presence of FIP in cats. It was essential to let the blood samples and all of the kit's components (Testsealabs) to get to room temperature before starting any testing. One drop of serum was then added to the sample well after a thirty to sixty second pause. The result can be read in eight to ten minutes after three drops of buffer are added to the sample well. The test kit yielded a positive result in this particular case.

2.8. Treatments

An antiviral medication called Inj. Ramdivir – 5mg/ml, Popular Pharmaceuticals Ltd. (Remdesivir 10mg/kg body weight) was given subcutaneously every day for eighty-four days in an amount of 6.5ml.

A 50 mg capsule of Cap. Doxicap, Renata Ltd. (doxycycline, 5 mg/kg body weight) was mixed with 5 ml of drinking water, and 2 ml was fed orally twice a day for ten days.

Inj. Roxadex - 5mg/ml, Nuvista Pharma Ltd., and was given subcutaneously in the dose (0.25mg/kg body weight) of 0.2ml once day for 7 days.

Tab. Pantonix - 20mg, manufactured by Incepta Pharmaceuticals Ltd. (Pantoprazole 1mg/kg body weight) was taken orally as 4mg once daily before meals for 10 days. Cyanocobalamin 50mcg/kg body weight was given as trade, Inj. Cynomim 1mg/ml, and Jayson Pharmaceuticals Ltd. 0.2 ml subcutaneously in two alternative days for five doses (maximum total dose 250mcg/cat).

Chapter 3: Results

Table 1: Biochemical parameters of blood serum

Blood analysis	Result	Reference value
Total protein	10.5 gm/dl	5.2-8.8(gm/dl)
Albumin	2.4 gm/dl	2.5-3.9(gm/dl)
Bilirubin	0.3 mg/dl	0.1-0.4(mg/dl)
AIT/SGPT	65.3	10-100(u/l)
AST/SGOT	39	10-100(u/l)
ALP	24.1	10-50(u/l)

In this case, the blood's biochemical test results revealed higher than expected levels of albumin, bilirubin, SGPT, and SGOT, as well as elevated levels of total protein (Table 1). A rise in the concentration of total serum proteins is a typical outcome of FIP in the laboratory (Paltrinieri et al., 2002).

On radiological test, it was revealed that the fluid accumulated in abdomen and this sign is correlated with FIP. Hence, the antibody rapid test (FIP Ab) kit also gave positive result to FIP as there are two distinct lines on the test cassette.

The cat received remdesivir (Inj. Ramdivir– 5mg/ml, Popular Pharmaceuticals Ltd.) at a dose of 6.5 milliliters per day for a total of eighty-four days in a row. During this time, he received no more antiviral treatment.

She had a noticeable improvement in her health and a decreased risk of illness in just seven days. It took some time for the diarrheal symptoms to get better. Her owner saw that after a month of taking the medication, the cat had become more energetic, appetite had gone from being insatiable to normal, and it appeared to be acting like a typical cat. There was no pain or discomfort during the injection, and no observable responses were observed at the injection site. With time, the muscle mass and coat both got better.

After three months of starting treatment, it was followed up by physical examination. It was weighed 4 kg with a body condition score of 3.5 out of 5, a slightly faster heartbeat, normal sweating, normal muscular tone and a hematological value that was better than normal. A clinical evaluation turned up nothing untoward in addition to the FIP Ab rapid test result being negative.

After completing the dose, again biochemical test was performed and the test results are normal within reference value.

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

Blood analysis	Result	Reference value
Total protein	7 gm/dl	5.2-8.8(gm/dl)
Albumin	3.7 gm/dl	2.5-3.9(gm/dl)
Bilirubin	0.3 mg/dl	0.1-0.4(mg/dl)
AIT/SGPT	87	10-100(u/l)
AST/SGOT	55	10-100(u/l)
ALP	46	10-50(u/l)

Chapter 4: Discussion

The initial biochemical test in present study indicated that the albumin level (2.4 gm/dl) was lower than the reference value, the total protein level (10.5 gm/dl) was higher. Furthermore, the albumin and TP levels were used to calculate the value of globulin (8.1 gm/dl). In the sample, the ratio of albumin to globulin was 0.3 which is positive for FIP (Pedersen, 2014). The results also showed that the level of SGOT was 39, the level of SGPT was 65.3, and the level of bilirubin was 0.3. ALP was found to be 24.1, which was within the normal range.

The biochemical test findings after giving successful treatment were shown in Table 2, where the levels of albumin, total protein and globulin were found 7 gm/dl, 3.7 gm/dl and 3.3 gm/dl respectively. The albumin-globulin ratio of the sample was 1.1, which is strongly correlated with a negative value for FIP (Jeffery et al., 2012;). The results showed that the SGPT level was 87, the SGOT level was 55, and the bilirubin level was 0.3. Both figures were significantly greater than the bilirubin level. It was discovered that the level of ALP was 46, which was within the normal range. The increase in gamma globulins might be primarily responsible for this concentration rise (Giordano et al., 2004;).

The likelihood of feline infectious peritonitis (FIP) should increase in the presence of decreased liver enzyme activity and elevated bilirubin levels without hemolysis (Hartmann, 2005). The investigation also yielded the important finding that the albumin to globulin ratio was 0.24. It was useful diagnostic tool because, in the event of liver damage, levels of albumin and globulin will decrease simultaneously (Rohrer et al., 1993). If the cat's serum albumin to globulin ratio is less than 0.4, there's a good chance that it has feline infectious peritonitis (Jeffery et al., 2012;). The FIP Ab rapid test is a necessary piece of equipment for FIP diagnosis (Addie et al., 2015). It is unlikely that cats in otherwise good health who have negative antibody test results are FCoV excretors or carriers (Felten et al., 2020;). The clinical signs and symptoms, in addition

to diagnostic assistance, are necessary to reach a diagnosis of FIP because the premortem diagnosis might be challenging.

In this study, remdesivir was subcutaneously given once daily for 84 days at a dose of 10 milligrams per kilogram of body weight in order to obtain superior outcomes in the treatment of non-effusive FIP which was similar to Bohm, 2022. The initial intravenous administration of remdesivir with a saline solution (Ringer's lactate solution) was recommended if the animal exhibit severe dehydration. Ethics issues surround the use of the prodrug GS-441524, which has been successfully used by other medical experts to treat FIP for at least 80 days at a dosage of 5 to 10 milligrams per kilogram of body weight (Bohm, 2022). To prevent a recurrent bacterial infection and pleasant respiratory symptoms, an order was placed for the antibiotic doxycycline to be taken orally at a dosage of 5 milligrams per kilogram of body weight twice daily for ten days (Bacek & Macintire, 2011; Dunowska & Ghosh, 2021). Dexamethasone, a steroidal anti-inflammatory drug, was administered subcutaneously once daily for seven days at a dose of 0.25 mg per kilogram of the patient's body weight to treat recurrent fever (Addie et al., 2020). For ten days, an antacid such as omeprazole was taken orally as a symptomatic and supportive treatment, 4 milligrams per kilogram of body weight before each meal (Marks, 2016; Meazzi et al., 2019). Furthermore, subcutaneous injections of cyanocobalamin (Vitamin B12) were administered on two different days at a dose of 50 milligrams per kilogram of body weight, for a total of five doses (Jones et al., 2021;).

Chapter 5: Conclusion

When the index of FIP suspicion rises, the physician must begin integrating diagnostic tests that will help and guide them toward a more conclusive diagnosis. This study showed that giving remdesivir subcutaneously for 84 days at a dose of 10 mg/kg was necessary to stop FCoV shedding in naturally infected cats. This treatment may be useful in creating cat households free of FCoV and also to save the life of FIP patients.

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Biography of Author

This is Nayeem-Been-Zaman, the child of DM Moniruzzaman and Sheeyesmin Khanom, doing his graduation on Doctor of Veterinary Medicine (DVM) at Chattogram Veterinary and Animal Sciences University under Faculty of Veterinary Medicine. He passed the Secondary School Certificate Examination (SSC) in 2015 from National Ideal School, Dhaka and got GPA 5.00 and then Higher Secondary Certificate Examination (HSC) in 2017 from Dhaka College, Dhaka and got GPA 5.00. Currently he is doing his yearlong internship. He has a great enthusiasm in his study area to develop day one skills and gain more practical knowledge to be prepared for the modern era of science.