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MANAGEMENT OF A CAT INFECTED WITH FELINE PANLEUKOPENIA VIRUS AND *MYCOPLASMA HAEMOFELIS* AT THE VETERINARY TEACHING HOSPITAL, HASANUDDIN UNIVERSITY

Penanganan Kucing yang Terinfeksi *Feline Panleukopenia Virus* dan Parasit Darah *Mycoplasma haemofelis* di Rumah Sakit Hewan Pendidikan Universitas Hasanuddin

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Abstract

Infectious diseases in domestic cats (*Felis catus*) remain a major challenge in veterinary practice, particularly in multi-etiological infections involving viral agents and hemotropic parasites. Coinfection with Feline Panleukopenia Virus (FPV) and Feline Hemotropic Mycoplasmosis (FHM) can cause severe immunosuppression, exacerbate clinical signs, and increase mortality risk, often accompanied by complications such as feline flu due to opportunistic secondary infections. This study aimed to describe the clinical management of a feline flu case in a cat infected with FPV and concurrent FHM at the Veterinary Teaching Hospital, Hasanuddin University. This case report describes a domestic cat presenting with vomiting, hemorrhagic diarrhea, anorexia, dehydration, and respiratory distress. Diagnosis was established based on anamnesis, clinical examination, hematological analysis, FPV rapid testing, blood smear examination, and bacterial culture. Therapeutic management included fluid therapy, antiviral treatment, culture-guided antibiotic therapy, antiparasitic treatment, nebulization therapy using salbutamol, as well as supportive and nutritional care. The results revealed that the cat tested positive for FPV, *Mycoplasma haemofelis* was detected on blood smear examination, and *Klebsiella pneumoniae* was isolated through bacterial culture. Comprehensive therapeutic management led to gradual clinical improvement. This case highlights the importance of an integrated diagnostic and therapeutic approach in the management of multi-etiological infections in cats.

Keywords: Feline Panleukopenia Virus, Feline Haemotrophic Mycoplasmosis, *Klebsiella pneumoniae*, nebulization therapy

Terakreditasi Nasional Sinta 4, berdasarkan Keputusan Direktur Jenderal Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021

Volume 18 No. 1: 161-170
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Abstrak

Penyakit infeksi pada kucing domestik (*Felis catus*) masih menjadi tantangan dalam praktik kedokteran hewan, terutama pada infeksi multietiologis yang melibatkan virus dan parasit darah. Koinfeksi *Feline Panleukopenia Virus* (FPV) dan *Feline Haemotrophic Mycoplasmosis* (FHM) dapat menyebabkan imunosupresi berat, memperburuk kondisi klinis, serta meningkatkan risiko mortalitas, yang sering disertai komplikasi flu akibat infeksi sekunder oportunistik. Studi ini bertujuan untuk mendeskripsikan penanganan klinis kasus flu pada kucing dengan infeksi FPV yang disertai FHM di Rumah Sakit Hewan Pendidikan Universitas Hasanuddin. Penelitian ini merupakan laporan kasus pada seekor kucing domestik dengan gejala muntah, diare berdarah, anoreksia, dehidrasi, dan gangguan pernapasan. Diagnosis ditegakkan melalui anamnesis, pemeriksaan klinis, pemeriksaan hematologi, *rapid test* FPV, ulas darah, dan kultur bakteri. Terapi yang diberikan meliputi terapi cairan, antivirus, antibiotik berbasis hasil kultur, antiparasit, terapi *nebulizer* menggunakan salbutamol, serta terapi suportif dan nutrisi. Hasil pemeriksaan menunjukkan kucing positif FPV, terdeteksi *M. haemofelis*, serta pertumbuhan *Klebsiella pneumoniae*. Terapi komprehensif menghasilkan perbaikan klinis secara bertahap. Kasus ini menegaskan pentingnya pendekatan diagnosis dan terapi yang komprehensif pada infeksi multietiologis pada kucing.

Kata kunci: Feline Panleukopenia Virus, Feline Haemotrophic Mycoplasmosis, *Klebsiella pneumoniae*, terapi nebulizer

INTRODUCTION

Diseases in domestic cats (*Felis catus*) remain a major challenge in veterinary medicine, particularly in cases involving mixed infections between viral agents and hemotropic parasites. One of the relatively common cases encountered at the Veterinary Teaching Hospital of Hasanuddin University is coinfection with Feline Panleukopenia Virus (FPV) and Feline Hemotropic Mycoplasmosis (FHM). Both diseases target the immune system, thereby exacerbating clinical conditions and increasing the risk of mortality (Barrs & Malik, 2019; Baneth & Tasker, 2021).

Feline panleukopenia is a highly contagious viral disease that primarily affects kittens or cats with compromised immune systems. The virus causes a marked reduction in white blood cell counts (leukopenia), gastrointestinal disturbances, and immunosuppression, which predisposes affected animals to secondary infections (Truyen & Parrish, 2021). In contrast, FHM, caused by *Mycoplasma haemofelis*, is a hemotropic parasitic infection that adheres to erythrocytes, leading to hemolytic anemia, lethargy, and anorexia (Tasker, 2018). When these two infections occur concurrently, the clinical condition of affected cats can deteriorate rapidly, necessitating prompt, comprehensive, and appropriate therapeutic intervention (Hartmann & Helps, 2020).

Management of cats with FPV and FHM coinfection requires a combination of supportive care, antiviral therapy, antibiotic treatment, as well as proper nutritional and environmental management. Upper respiratory tract disease or feline flu, which frequently develops in such cases, represents an additional complication that further worsens the patient's condition (Lappin & Levy, 2022). Therefore, a multidisciplinary approach involving clinical veterinarians, pathologists, and diagnostic laboratory personnel is essential to determine the most effective therapeutic strategy.

This study aimed to describe the clinical management of a feline flu case associated with FPV and FHM coinfection at the Veterinary Teaching Hospital of Hasanuddin University. Through this case report, it is expected to provide a comprehensive overview of clinical manifestations,

Terakreditasi Nasional Sinta 4, berdasarkan Keputusan Direktur Jenderal
Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021

Volume 18 No. 1: 161-170
February 2026
https://doi.org/10.24843/bulvet.2026.v18.i01.p15

diagnostic findings, and therapeutic strategies that may improve recovery rates and reduce mortality in similar cases encountered in clinical practice.

RESEARCH METHODS

Case details

A client presented a 5-year-old female purebred cat weighing 3 kg to the Veterinary Teaching Hospital of Hasanuddin University for clinical examination. The primary complaints included anorexia, lethargy, pale oral mucous membranes, bloody diarrhea, and yellow-colored vomiting. The medical history revealed that the cat had never received any vaccinations. In addition, the cat was frequently allowed to roam freely in the surrounding environment, increasing the risk of exposure to infectious agents from other animals and contaminated environments.To support diagnostic evaluation, hematological examination, FPV rapid testing, blood smear examination, and bacterial culture of nasal discharge were performed.

Hematological Examination

Hematological analysis was conducted by collecting a blood sample from the cephalic vein using a sterile syringe, which was subsequently placed into an EDTA tube. The blood sample was analyzed using a CC-3200 Vet hematology analyzer to evaluate hematological parameters, including total leukocyte count, leukocyte differential, erythrocyte count, hemoglobin concentration, hematocrit value, and platelet count. This examination aimed to assess inflammatory status, the degree of immunosuppression, and the presence of anemia or other hematological disorders commonly associated with FPV infection and hemotropic parasitic infections. Alterations in leukocyte and neutrophil counts may indicate secondary bacterial infection in immunosuppressed patients (Thrall *et al.*, 2012; Weiss & Wardrop, 2019).

FPV Rapid Test

FPV rapid testing was performed using an FPV rapid test cassette, sterile swabs, extraction tubes containing buffer solution, a dropper, and personal protective equipment, including gloves and a mask. The cat was appropriately restrained to minimize stress and prevent excessive movement. Fresh fecal samples or rectal swabs were collected by gently inserting a sterile swab into the rectum and rotating it several times to ensure adequate sample collection.

The swab containing the sample was then placed into the extraction buffer tube, rotated, and pressed against the tube wall for several seconds to extract viral antigens before being removed while squeezing to recover the liquid. Subsequently, 2–3 drops of the extracted solution were applied to the sample well (S) of the rapid test cassette. The cassette was placed on a flat surface, and results were read after an incubation period of approximately 10–15 minutes.

Interpretation of results was based on the appearance of indicator lines on the cassette: a single line in the control region (C) indicated a negative result, two lines in both the control (C) and test (T) regions indicated a positive FPV result, while absence of a control line indicated an invalid test. This method was chosen due to its relatively high sensitivity and specificity and its ability to rapidly detect FPV antigens in cats presenting with acute gastrointestinal clinical signs (Decaro & Buonavoglia, 2012; Greene, 2020).

Blood Smear Examination

The blood smear procedure began with the preparation of clean glass slides, a spreader slide, fresh blood, and personal protective equipment, including gloves and a mask. Blood samples were collected aseptically from a vein using a syringe or capillary tube, and a small drop of blood was placed approximately 1 cm from one end of a glass slide. The spreader slide was positioned in front of the blood drop at an angle of 30–45 degrees and gently drawn backward

Terakreditasi Nasional Sinta 4, berdasarkan Keputusan Direktur Jenderal
Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021

Volume 18 No. 1: 161-170
February 2026
https://doi.org/10.24843/bulvet.2026.v18.i01.p15

until it contacted the blood, allowing the blood to spread evenly along the edge of the spreader. The spreader slide was then pushed forward in a single, smooth, and steady motion to create a thin and uniform blood film on the glass slide.

The blood smear was air-dried without the application of heat. Once dry, the smear was fixed with methanol for 2–3 minutes and allowed to dry again. Staining was performed using Giemsa stain according to standard procedures, followed by rinsing with running water and air-drying. The prepared smear was subsequently examined under a microscope to evaluate erythrocyte, leukocyte, and platelet morphology. Blood smear examination is a simple yet effective method for detecting hemotropic infections in cats (Tasker, 2018; Harvey, 2012).

Bacterial Culture

Bacterial culture was performed by collecting nasal and oropharyngeal secretions using sterile swabs. The procedure began with the preparation of appropriate culture media, including nutrient agar, blood agar, eosin methylene blue agar (EMBA), or MacConkey agar, which were sterilized and aseptically poured into Petri dishes. All procedures were conducted near a Bunsen burner flame or within a biosafety cabinet to prevent contamination.

Samples intended for culture, including swabs, fluids, or tissue specimens, were inoculated onto the surface of the culture media using a sterile inoculating loop and a streaking technique to obtain isolated colonies. After inoculation, the Petri dishes were covered, labeled with sample identification and date, and incubated in an incubator at an appropriate temperature, generally 35–37°C for 18–24 hours or longer, depending on the bacterial species.

Following the incubation period, bacterial growth was assessed based on the presence of colonies, including their shape, color, size, and surface characteristics. Bacterial culture aimed to identify bacterial agents responsible for secondary respiratory infections and to provide a basis for appropriate and rational antibiotic selection. Culture examination is particularly important in immunosuppressed patients to avoid inappropriate empirical antibiotic use (Quinn *et al.*, 2011; Markey *et al.*, 2013).

RESULTS AND DISCUSSION

Results

Based on the clinical examinations performed, several findings indicated a severe systemic disorder with evidence of multi-organ involvement, particularly affecting the gastrointestinal and respiratory systems. Rectal temperature measurement revealed a value of 39.9°C, which was at the upper limit of the normal range for cats. Capillary refill time (CRT) and skin turgor assessment showed prolonged capillary refill and reduced skin elasticity, both exceeding 3 seconds. Respiratory examination revealed an increased respiratory rate of 48 breaths per minute with a costal breathing pattern.

Clinical signs of mild rhinitis and conjunctivitis were observed, including nasal discharge, repeated sneezing, and clear to mucoid ocular discharge (Figure 1a). Pulse rate was recorded at 104 beats per minute. Clinically, the cat exhibited marked dehydration, generalized weakness, reduced responsiveness to mild stimuli, and a depressed mental state. According to the owner's history, the cat presented with yellow-colored vomiting, bloody diarrhea, anorexia, and lethargy. The anamnesis further revealed that the cat had never been vaccinated and was frequently allowed to roam freely. Additional physical findings included oral ulceration, a dull hair coat, and overall lethargy.

Hematological examination (Table 1) revealed leukocytosis (WBC 25.4 × 10^9/L) with increased granulocyte percentage (73.6%) and decreased lymphocyte percentage (4.1%). The hematocrit

Terakreditasi Nasional Sinta 4, berdasarkan Keputusan Direktur Jenderal
Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021

Volume 18 No. 1: 161-170
February 2026
https://doi.org/10.24843/bulvet.2026.v18.i01.p15

value was 37.7%, and platelet count was elevated at 455 × 10^9/L. The FPV rapid test yielded a positive result, confirming FPV infection (Figure 1b).

Bacterial culture examination demonstrated the growth of bacterial colonies identified as *Klebsiella pneumoniae*. Morphologically, the bacteria were Gram-negative rods, forming pink to reddish, smooth, and mucoid colonies (Figure 2a). Peripheral blood smear examination revealed small bluish, dot-like structures attached to the surface of erythrocytes, which were identified as characteristic inclusion bodies of *Mycoplasma haemofelis* (Figure 2b).

Antiviral therapy with molnupiravir was administered to the cat. In addition, external antiparasitic treatment in the form of topical ectoparasiticide was applied. Supportive therapy was provided to stabilize the patient's condition and enhance immune function. Ringer's lactate fluid therapy was administered to correct dehydration, maintain electrolyte balance, and improve tissue perfusion. Nutritional and immunomodulatory supplements, including curcumin and Imboost®, were given to support metabolism, stimulate appetite, and enhance immune response. Hematodin® was administered to support hematopoiesis, improve anemia-related conditions, and maintain nutritional status.

As part of the management of respiratory signs (feline flu), nebulization therapy was performed using 0.9% NaCl solution combined with salbutamol. The therapy was administered in a closed nebulization chamber at a dose of 0.5–1 mL salbutamol diluted in 3–5 mL of 0.9% NaCl, for 10–15 minutes per session, twice daily (Figure 3). Following several treatment sessions, a reduction in sneezing frequency, improvement in respiratory regularity, decreased nasal mucus secretion, and a gradual improvement in appetite were observed.

Discussion

Rectal temperature at the upper limit of the normal range indicated mild hyperthermia, which may result from the host's physiological response to viral and bacterial infections as well as ongoing inflammatory processes within the body. Prolonged capillary refill time (CRT) and reduced skin turgor reflected moderate to severe dehydration, most likely caused by excessive fluid loss due to persistent vomiting and severe diarrhea, as reported during anamnesis. The presence of costal breathing accompanied by an increased respiratory rate suggested a compensatory mechanism in response to hypoxia or metabolic disturbances associated with systemic infection. This condition supports the suspicion of severe feline flu affecting the upper respiratory tract, which commonly occurs as an opportunistic secondary infection in cats experiencing immunosuppression due to FPV. Respiratory pathogens such as Feline Herpesvirus (FHV-1) and Feline Calicivirus (FCV) are frequently implicated in such conditions.

The pulse rate, which was at the lower limit of the normal range, was presumed to be associated with generalized weakness resulting from dehydration and decreased systemic blood pressure. Clinically, the combination of gastrointestinal disturbances, respiratory involvement, and deterioration of general condition is consistent with findings reported by Norsworthy *et al.* (2021), who described complex systemic manifestations in cats suffering from severe virus-induced immunosuppression.

Hematological findings of leukocytosis and granulocytosis indicated the presence of secondary bacterial infection, while lymphopenia reflected the immunosuppressive effects of FPV on the lymphoid system. These findings are in agreement with Stuetzer & Hartmann (2014), who reported that FPV disrupts immune function, thereby triggering secondary inflammatory responses to opportunistic pathogens. Elevated granulocyte counts are also a typical feature of acute bacterial infections (Tilley & Smith, 2017). The positive FPV rapid test result confirmed

Terakreditasi Nasional Sinta 4, berdasarkan Keputusan Direktur Jenderal
Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021

Volume 18 No. 1: 161-170
February 2026
https://doi.org/10.24843/bulvet.2026.v18.i01.p15

FPV as the primary infectious agent in this case. FPV primarily targets intestinal epithelial cells, bone marrow, and lymphoid tissues, resulting in intestinal mucosal damage, impaired hematopoiesis, and severe immunosuppression (Greene, 2020). Decaro *et al.* (2018) reported that FPV coinfection with other pathogens, including bacteria and hemotropic parasites, significantly increases mortality risk, particularly in unvaccinated cats.

The identification of *Klebsiella pneumoniae* through bacterial culture explained the severe respiratory signs observed in the patient. This opportunistic Gram-negative bacterium possesses a polysaccharide capsule as a major virulence factor, enabling it to evade phagocytosis in hosts with compromised immune systems. Culture-guided antibiotic therapy, along with nebulization therapy using salbutamol, was therefore implemented to reduce bronchospasm and improve pulmonary ventilation (Nelson & Couto, 2020).

The detection of *Mycoplasma haemofelis* on peripheral blood smear confirmed the presence of FHM, which contributed to hematological abnormalities and further aggravated the clinical condition. Concurrent infection with FPV and *M. haemofelis* has been reported to exacerbate hematological disorders and worsen prognosis (Watanabe *et al.*, 2017). Administration of the antiviral agent molnupiravir was expected to suppress viral replication through its mechanism as a nucleoside analog that induces errors during viral RNA genome replication. Although its clinical efficacy in veterinary patients is still under investigation, the use of this antiviral agent was anticipated to shorten disease duration and reduce mortality risk in severe viral infections.

Supportive therapy, including Ringer's lactate fluid therapy, curcumin supplementation, Imboost®, Hematodin®, and phytotherapeutic agents such as Fufang E'Jiao Jiang, played a critical role in supporting metabolic function, enhancing immune response, and accelerating tissue recovery. Wulandari *et al.* (2020) reported that curcumin acts as a potent antioxidant and immunomodulator, supporting recovery processes in animals with chronic infections.

The observed clinical improvements, including reduced vomiting, improved respiratory function, and gradual restoration of appetite, demonstrated the effectiveness of combining pharmacological and supportive therapies. This finding aligns with the theory proposed by Radostits *et al.* (2017), which emphasizes that optimal supportive care can accelerate tissue regeneration and improve clinical prognosis. Overall, this case underscores the importance of comprehensive diagnostic evaluation and a multidisciplinary therapeutic approach in managing multietiology systemic infections in cats. Preventive measures, including FPV vaccination, environmental control, and immune system enhancement, remain the primary strategies for reducing the risk of similar cases in the future (Nelson & Couto, 2020).

CONCLUSIONS AND SUGGESTIONS

Conclusions

This case demonstrated a multietiological infection in a domestic cat, with Feline Panleukopenia Virus (FPV) identified as the primary infection, accompanied by secondary infections with *Klebsiella pneumoniae* and *Mycoplasma haemofelis*. These concurrent infections resulted in systemic disorders, including severe feline flu, vomiting, hemorrhagic diarrhea, and mild anemia. Diagnostic confirmation was achieved through a combination of FPV rapid testing, hematological analysis, peripheral blood smear examination, and bacterial culture. Clinical management involving fluid therapy, culture-guided antibiotic therapy, doxycycline administration, salbutamol nebulization, Fufang E'Jiao Jiang supplementation, and curcumin supplementation resulted in favorable clinical outcomes with gradual improvement of the patient's condition.

Terakreditasi Nasional Sinta 4, berdasarkan Keputusan Direktur Jenderal
Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021

Volume 18 No. 1: 161-170
February 2026
https://doi.org/10.24843/bulvet.2026.v18.i01.p15

Suggestions

Based on the findings of this case, routine vaccination is strongly recommended to prevent FPV infection, along with improved environmental sanitation to reduce the risk of secondary bacterial and hemotropic parasitic infections. Regular health examinations at veterinary hospitals are particularly important for cats that are frequently allowed to roam freely, enabling early detection of infectious diseases before the onset of severe clinical signs.

In addition, the periodic use of immunomodulatory supplements, such as Fufang E'Jiao Jiang and curcumin, may be considered to support immune function and enhance disease resistance. The implementation of appropriate supportive therapy guided by laboratory findings should serve as a fundamental approach in managing cases of coinfection, in order to optimize therapeutic success and reduce mortality risk. Preventive strategies, including routine vaccination, environmental hygiene, and immune support, are essential to minimize the recurrence of similar cases.

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Volume 18 No. 1: 161-170
February 2026
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Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021

Volume 18 No. 1: 161-170
February 2026
https://doi.org/10.24843/bulvet.2026.v18.i01.p15

Tables

Tabel 1. Blood hematology results

Parameter	Results	Unit	Reference range*	Interpretation
WBC	25.4	10^9/L	5.5-19.5	↑ Increased
Limfosit	4.1	10^9/L	0.8-7.0	Normal
Mid#	2.7	10^9/L	0.1-1.5	↑ Increased
Granulosit	18.6	10^9/L	2.0-9.5	↑ Increased
Limfosit (%)	16.1	%	20.0-55.0	↓ Decreased
Mid (%)	10.6	%	1.0-15.0	Normal
Gran (%)	73.5	%	35.0-85.0	Normal
RBC	6.8	10^{12}/L	5.0-10.0	Normal
HGB	13.5	g/dL	9.3-15.9	Normal
HCT	37.4	%	28.0-49.0	Normal
MCV	54.7	fL	39.0-55.0	Normal
MCH	19.9	pg	13.0-20.0	Normal
MCHC	289	g/L	300-380	↓ Decreased
RDW-CV	17.0	%	14.0-20.0	Normal
RDW-SD	26.3	fL	30.0-60.0	↓
PLT	455	10^9/L	100-514	Normal
MPV	9.5	fL	5.0-20.0	Normal
PDW	9.4	fL	10.0-500.0	Normal
PCT	0.432	%	0.0-0.500	Normal
P-LCC	277	10^9/L	10.0-70.0	↑ Increased
P-LCR	60	%	-	-
Eosinofil (%)	2.4	%	0.0-6.0	Normal

Abbreviations: WBC=white blood cell; RBC=Red blood cell; HGB=Hemoglobin; HCT= Hematokrit; MCV=Mean Corpuscular Volume; MCH=Mean Corpuscular Hemoglobin; MCHC=Mean Corpuscular Hemoglobin Concentration; RDW-CV=Red Cell Distribution Width–Coefficient of Variation; RDW-SD=Red Cell Distribution Width–Standard Deviation; PLT=Platelet; MPV=Mean Platelet Volume; PDW=Platelet Distribution Width; PCT=Plateletcrit; P-LCC=Platelet Large Cell Count; P-LCR=Platelet Large Cell Ratio. *Reference: Hematology Analyzer CC-3200 Vet.

Terakreditasi Nasional Sinta 4, berdasarkan Keputusan Direktur Jenderal
Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021

Volume 18 No. 1: 161-170
February 2026
https://doi.org/10.24843/bulvet.2026.v18.i01.p15

Figures

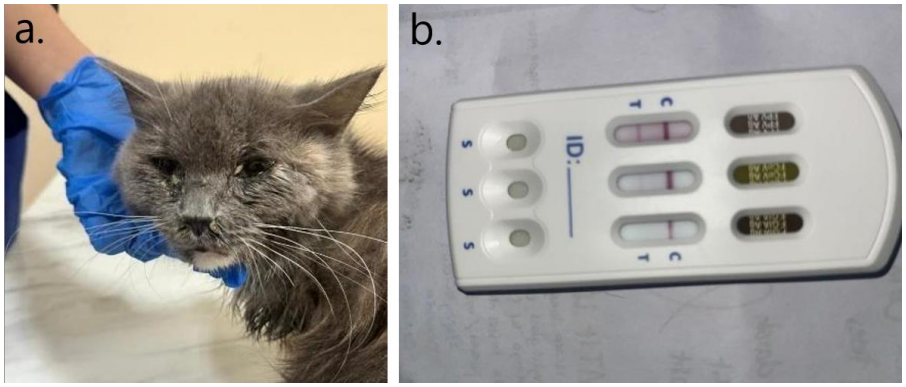

Figure 1. (a) The cat in a lethargic condition with nasal discharge and ocular secretions. (b) FPV rapid test result showing two lines in the control (C) and test (T) regions, indicating a positive result.

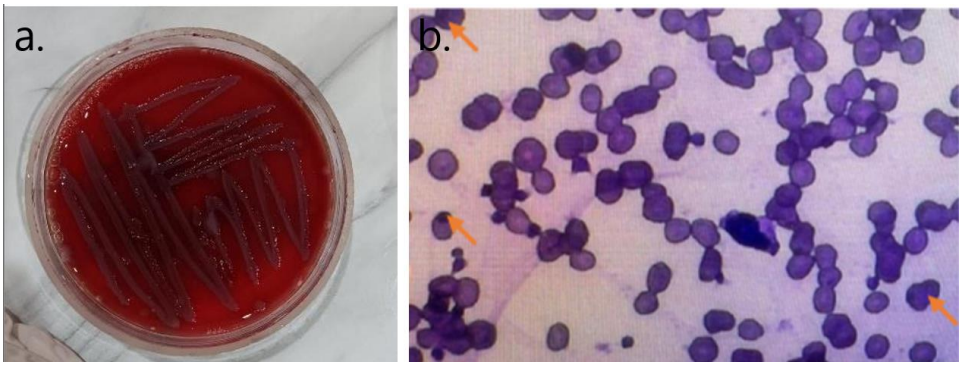

Figure 2. Supportive diagnosis (a) Bacterial culture on eosin methylene blue agar (EMBA) showing pink to reddish, smooth, and mucoid bacterial colonies. (b) Peripheral blood smear demonstrating the presence of *Mycoplasma haemofelis* attached to the surface of erythrocytes, stained with Giemsa and observed at 400× magnification.

Figure 3. Nebulization therapy using 0.9% NaCl solution combined with salbutamol, administered in a closed nebulization chamber.

Terakreditasi Nasional Sinta 4, berdasarkan Keputusan Direktur Jenderal
Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021