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DIAGNOSIS OF PYOTHORAX IN DOMESTIC CATS

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Abstract

Pyothorax is a disorder of the respiratory system that commonly occurs in beloved pets. A case report on a 5-year-old male domestic cat with clinical symptoms of lethargy, dyspnea, abnormal lung sounds, and reluctance to move. Supporting diagnostic examinations include hematology and blood biochemistry tests, X-ray imaging, Feline Leukemia Virus (FeLV) antigen test, Feline Immunodeficiency Virus (FIV) antibody test, Feline Coronavirus (FCoV) Polymerase Chain Reaction (PCR), fluid smear analysis, and ultrasonography examination. Clinical examination and palpation of the thoracic area showed decreased fremitus, pain, and increased thoracic wall resistance. The results of X-ray imaging and ultrasonography showed accumulation of viscous fluid in the thoracic region. The results of the FeLV, FIV, and FCoV PCR tests were negative. The smear test of the collected viscous, yellow fluid showed cocci-shaped bacteria and leukocytes. These findings indicate pyothorax.

Keywords: pyothorax, cocci, X-ray, ultrasonography

INTRODUTION

Pyothorax, otherwise known as thoracic empyema, is a respiratory problem that often occurs in cats, namely the accumulation of purulent exudate in the pleural cavity (Stillion and Letendre, 2015). This condition is life-threatening because it can cause pulmonary compression, gas exchange disorders, septic shock, and eventually respiratory failure. In cats, pyothorax most often occurs secondary to bacterial infections in the pleural cavity, with the main etiology being bite wounds that penetrate the thoracic wall (Dempsey and Taylor, 2023). More than 80% of feline pyothoraxes are caused by mixed anaerobic bacterial infections (Little, 2012). Feline pyothorax is often associated with polymicrobial infections consisting of obligate anaerobic bacteria (such as Clostridium spp., Fusobacterium spp., Bacteroides spp.) and facultative aerobic bacteria (such as Pasteurella spp. and Actinomyces spp.) (Waddell et al., 2002; Barrs et al., 2005).

Less than 20% of cases are caused by non-oropharyngeal bacteria such as Escherichia coli, Salmonella spp., Klebsiella spp., Pseudomonas spp. and Nocardia spp. (Gorris et al., 2017). Mycoplasma is a potential cause of pyothorax in kittens (Gulbahar and Gurturk, 2002) and adult cats that are immunosuppressed

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(Foster et al., 2004). Almost 80% of pyothorax cats do not have vaccination status against feline herpesvirus and feline calicivirus. Clinical signs in cats with pyothorax often manifest as shortness of breath, abnormal lung sound during auscultation. Radiographic signs found include pulmonary lobe retraction, increased lobar edges, and interlobar fissures, which are classic signs of pleural effusion (Stillion and Letendre, 2015). Complex parapneumonic diffusion can develop into pyothorax when pus formation occurs (Barrs and Beatty, 2009).

Aggressive management is essential for recovery, including stabilization with oxygen therapy, adequate pus drainage, and parenteral administration of broad-spectrum antibiotics. The prognosis varies from good to poor, highly dependent on the speed of intervention and response to therapy (Swinger & Barton, 2024).

Cats with access to the outdoors and unneutered male cats are at higher risk due to their tendency to engage in fights. The diagnosis is established through a combination of anamnesis, clinical examination, confirmation through analysis of pleural fluid obtained through thoracentesis, and imaging with X-rays and ultrasound.

MATERIALS AND METHODS

One domestic cat of male sex, body weight 2.25 kg, age 5 years. Clinical symptoms: dyspnea, weakness, lethargy, lazy movement, body temperature 39.3°C. Palpation and auscultation were performed in the thoracic area. X-ray examinations were carried out to determine the anatomical condition of the organs in the thoracic area. Supporting diagnostic examinations in the diagnosis include haematological and biochemical blood tests, Feline Leukemia Virus (FeLV) antigen tests and Feline Immunodeficiency Virus (FIV) antibodies, FCoV Polymerase Chain Reaction (PCR) tests, fluid smear examinations and ultrasound examinations.

RESULTS AND DISCUSSION

Hematology and Blood Biochemistry Examination

Hematological and blood biochemical examinations are carried out to detect abnormalities in the blood and organ function disorders. The results of the hematology examination are presented in Table 1, and blood biochemistry is presented in Table 2.

Imaging Test (X-Ray)

Imaging tests using X-rays were carried out on the thorax and abdomen. Radiopaque images were obtained in the thoracic area, which caused the heart organ to be not clearly visible, and in the kidneys, the presence of minerals was found (Figure 2).

Tes Antigen FeLV dan Antibodi FIV

FeLV antigen and FIV antibody tests were performed on patients using blood samples given EDTA anticoagulants. Positive results were characterized by the formation of red lines in the control (C) and test (T) sections, negative if the red line was only in the control section (C) and invalid if the red line was only in the test section (T) (Figure 3).

PCR tests

Polymerase Chain Reaction (PCR) is performed to identify asymptomatic as well as mutated FCoV-infected cats. The PCR test results of the "Feline Coronavirus & Feline Infectious Peritonitis Mutation PCR Panel" are presented in Table 3 and Graphs 1 and 2.

Fluid Smear Examination

Thoracocentesis is carried out to collect diagnostic specimens so that it can be continued with fluid smear examination. The results of thoracentesis were obtained with the accumulation of thick yellow thoracic pus fluid (Figure 4). The results of imaging tests with X-rays and ultrasound examination of the thoracic area are presented in Figures 5 and 6.

Based on the results of the anamnesis, clinical examination, and supporting diagnostic examinations as well as thoracentesis, it was found that the accumulation of cloudy yellow pus fluid in the pleural cavity was obtained, so the patient was diagnosed with pyothorax. The differential diagnosis is Feline Herpesvirus. The results of the thoracentesis were followed by a fluid smear examination, and cocci-shaped bacteria and inflammatory cells were found. Therefore, the suspected occurrence of pyothorax is caused by a bacterial infection, but the type or species of the causative bacteria must be isolated and identified so that it is known for certainty. The prognosis for this case is dubius-infausta (Almendros, 2021).

The education that can be given to the owner is to suggest hospitalization for the patient so that the condition can be monitored intensively because the condition of pyothorax tends to interfere with the physiological condition of body fluids which can affect the sudden rise or fall of body temperature, respiratory frequency, and heart rate. The cause of pyothorax in cats is often bacteria, so maintaining the sanitary and hygiene conditions of the cage, food, and drinks given must be considered. The cure rate for pyothorax cases is doubtful, as it cannot be cured because this condition often appears repeatedly; even unilateral cases can become bilateral pyothorax. Other suggestions given are thoracotomy in conditions when various medical therapies have failed and when localized effusions have spread.

Pyothorax is a disease caused by pathogenic microbes, characterized by the accumulation of purulent exudate in the pleural space, also known as thoracic empyema. Accumulation of intrapleural fluid with a high number of white blood cells, a large percentage of inflammatory cells and a variable type of bacteria. Most cases of pyothorax are polymicrobial (Walker et al., 1998), but some studies have found that pyothorax is a single-organism infection (Diaz *et al*., 2021). Clinical symptoms arising from fluid accumulation in the pleural space are dyspnea, respiratory distress (often on inspiration), abnormal pulmonary sound accompanied by percussion (Kuehn, 2019). The most frequent clinical presentations include dyspnea (75%), gross lung sound (75%), breathing condition with the mouth open (64.3%), breathing with the stomach (57.1%), tacupnea (39.3%), lethargy (39.3%), anorexia (39.93%), dehydration (35.7%) and discharge through the eyes or nose (28.6%) (Sim *et al*., 2021). Hematogenous or lymphatic spread, direct inoculation through penetrating bite wounds, parasitic migration, parapneumonic spread, and foreign body migration are the pathways for feline pyothorax infection (Epstein, 2014).

Radiographically, in the lateral recumbency position, white (radiopaque) is obtained in the lungs; white (opaque) indicates a liquid period or solid period, but the type is not yet known; while in the dorsal recumbency position, there is something homogeneous that covers the lung area (Hasanah, 2022). Pleural

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effusion often has the characteristics of septic exudate that is cloudy to opaque in beige or pale yellow but can also be pink, green, or red (Little, 2012). Pyothorax is also another diagnosis that occurs due to secondary infections. Some other causes of pyothorax are parasitic migration, lung abscesses, bite wounds in the chest, pneumonia and secondary lung infections that enter through bacterial aspiration (Morgan, 2018). Thoracosynthesis allows the collection of specimens so that cytology and bacterial culture examinations can be carried out in diagnosing pyothorax (Stillion and Letendre, 2015).

In total, 67.9% of cats experience bilateral effusion (Demetriou et al., 2002). The pleural fluid may remain unilateral if the fluid is so thick that the pleuro-mediastinal space is not fenestrated or the fenestration becomes closed due to inflammation or blockage (Beatty and Barrs, 2010). Thus, unilateral effusion may remain unilateral or develop into a bilateral distribution. Unilateral chest tube insertion is indicated when there is unilateral effusion and if effective drainage can be performed leaving little residual effusion (Epstein and Balsa, 2020). Bilateral chest tubes are indicated in cases of bilateral effusion (Odunayo, 2016) and this method provides effective drainage in cases of persistent fluid locularity (Barrs and Beatty, 2009). Amoxicillin-clavulanate is the antimicrobial of choice against aerobic bacteria and should be administered in combination with antimicrobials that include anaerobic bacteria. Chest tube insertion is important for the success of treatment in reducing the presence of fluid in the pleural cavity so that breathing will be easier in pyothorax cats (Sim et al., 2021). Enrofloxacin is also an antimicrobial to increase the coverage of Gram-negative bacteria in its mechanism of action, which is often an option in the treatment of feline pyothorax cases in Malaysian veterinary clinics.

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Table 1. Results of hematological examination of the blood of pyothoracic cats

No	Parameter	Units	Normal Values	Results	Remarks
1	White Blood Cells (WBC)	109/L	3.5–20.7	26.67	Increase
2	Lymphocytes (LYM)	109/L	0.83–9.1	2.07	-
3	Monosit (MON)	109/L	0.09–1.21	2.53	Increase
4	Neutrophil (NEW)	109/L	1.53–13.37	21.3	Increase
5	Eosinophil (EOS)	109/L	0.02–0.49	0.73	Increase
6	Basophile (BAS)	109/L	0.00–0.20	0.06	-
7	Red Blood Cells (RBC)	1012/L	7.70–12.80	5.94	Decrease
8	Hemoglobin (HGB)	g/dL	10–17	9.5	Decrease
9	Hematocrit (HCT)	%	33.7–55.4	33.12	Decrease

Table 2. Results of biochemical examination of pyothoraxic cat blood

No	Parameter	Units	Normal Values	Results	Remarks
1	Albumin	g/dL	2.2–4.4	2.5	-
2	Alkaline Phosphatase	U/L	10–90	12	-
3	Alanine Transaminase	U/L	20–100	107	Increase
4	Total Bilirubin	mg/dL	0.1–0.6	1.4	Increase
5	Blood Urea Nitrogen	mg/dL	10–30	22	-
6	Calcium	mg/dL	8–11.8	10.1	-
7	Phosphorus	mg/dL	3.4–8.5	3.9	-
8	Creatinine	mg/dL	0.3–2.1	1.0	-
9	Glukosa	mg/dL	70–150	162	Increase
10	Sodium (Na+)	mmol/L	142–164	137	Decrease
11	Potassium (K+)	mmol/L	3.7–5.8	3.5	Decrease
12	Total Protein	g/dL	5.4–8.2	9.5	Increase
13	Globulin	g/dL	1.5–5.7	7.0	Increase

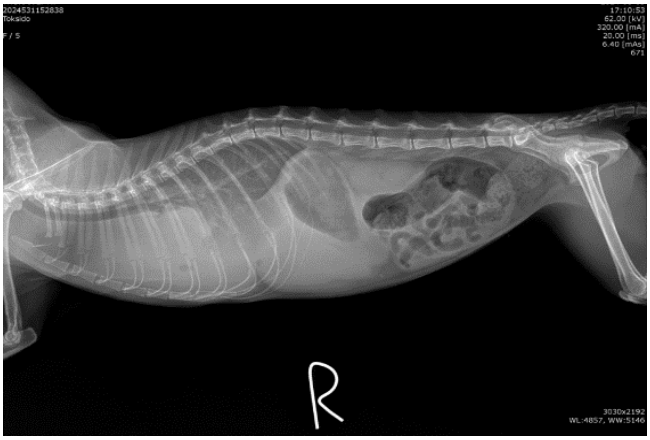


Figure 2. Results of X-ray imaging tests. (A) In the lateral recumbency position, fluid deposits can be seen in the chest cavity that almost cover the entire cavity (red arrow). There is mineralization in the kidneys (yellow arrow). (B) In the dorsoventral position, fluid deposits can be seen in almost all cavities, both dexter and sinister (red arrow).

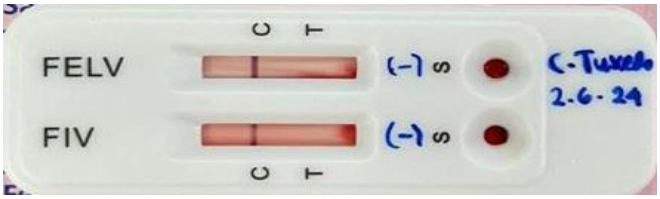


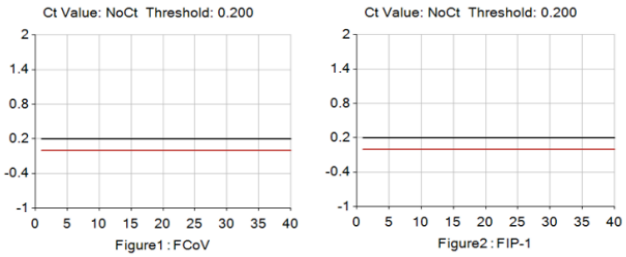
Figure 3. Negative results of FELV antigen and FIV antibody tests.

Table 3. PCR, FCoV, and FIP test results

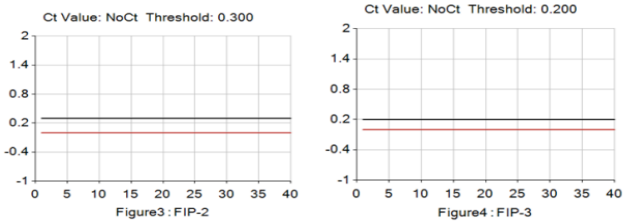
Test	Ct Value	Normal Values	Results
FCoV	NoCt	>36 or No Ct	Negative (-)
FIP-1	NoCt	>39 or NoCt	Negative (-)
FIP-2	NoCt	>39 or NoCt	Negative (-)
FIP-3	NoCt	>39 or No Ct	Negative (-)

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Graph 1. The results of the Ct values of FCoV and FIP-1 respectively.



Graph 2. The results of the Ct values of FIP-2 and FIP-3, respectively.

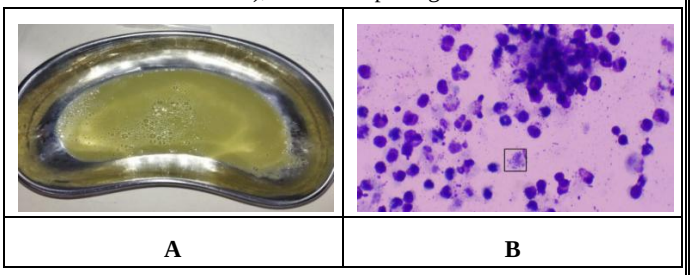


FCoV

- Ct <16: extremely high pathogen content; 16<Ct<26 : high pathogen content; 26<Ct<36 : low pathogen content (pathogen detectable)
- Ct >36: no or extremely low pathogen content (below the detection limit); NoCt: no pathogen detected

FIP

- Ct <19: extremely high pathogen content; 19<Ct<29 : high pathogen content; 29<Ct<39 : low pathogen content (pathogen detectable)
- Ct >39: no or extremely low pathogen content (below the detection limit); No Ct: no pathogen detected



A **B**

Figure 4. Fluid smear examination. (A) Thick yellow thoracic fluid collected through thoracentesis. (B) The results of the fluid smear examination showed coccus bacteria (arrows and black boxes) and leukocytes (red arrows).

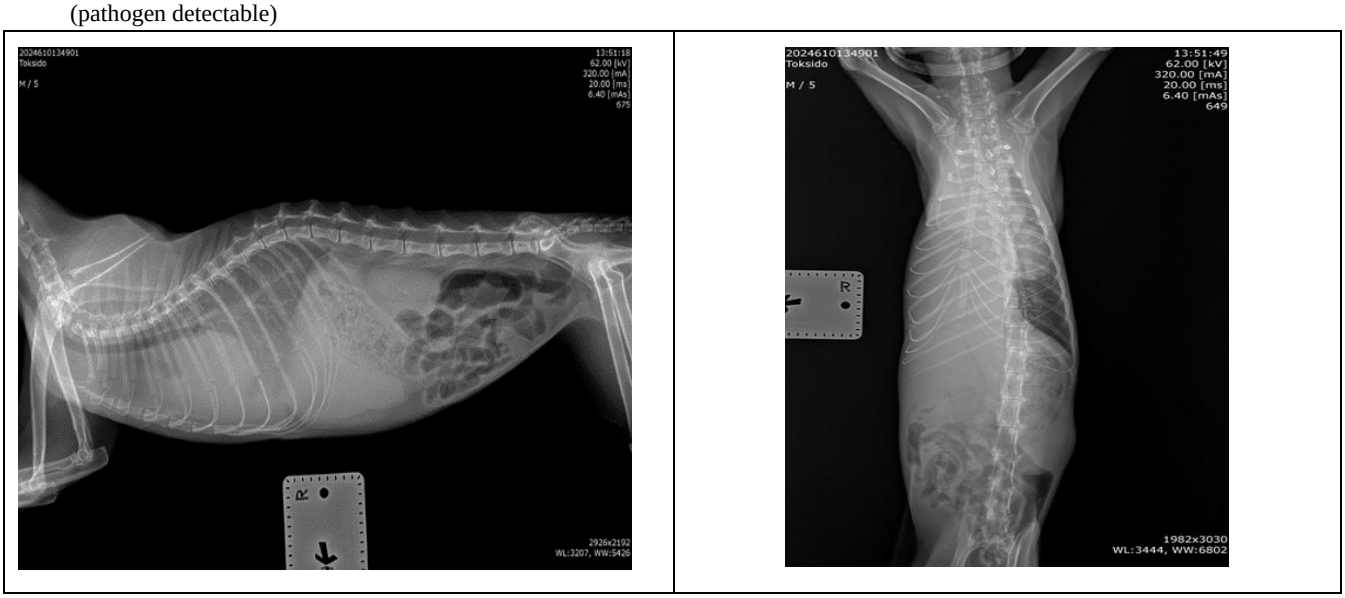
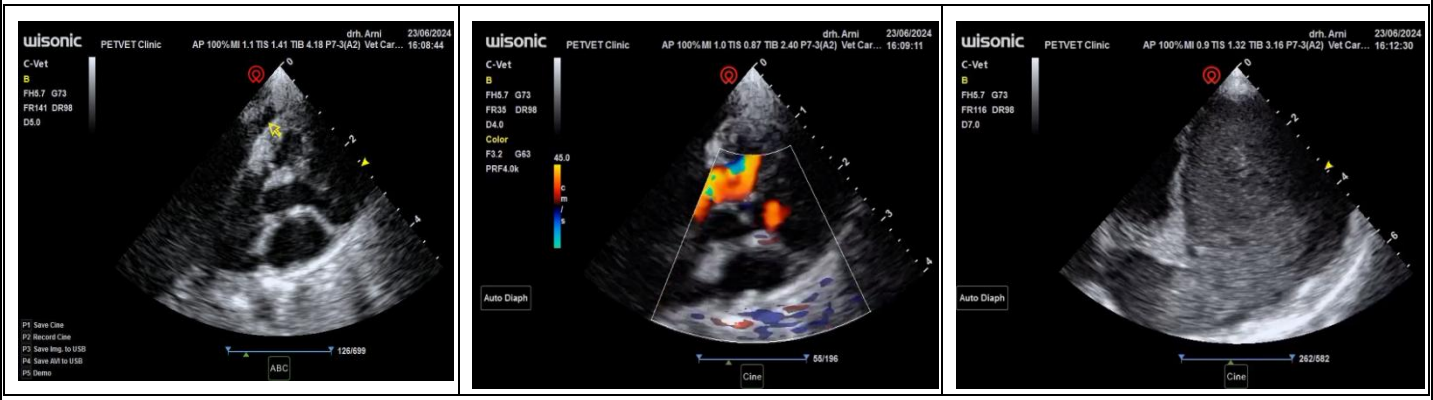


Figure 5. Results of X-ray imaging tests. (A) In the lateral position of recumbency, fluid accumulation is still visible in the chest cavity (appears to have decreased since the last examination), and the apex of the heart begins to be seen (red arrow). (B) In the ventrodorsal (VD) or dorsoventral (DV) position, fluid deposits are seen in the chest cavity (visible in the last examination), fluid accumulation is more visible in the dexter (red arrow).



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Figure 6. Ultrasound examination of the thoracic area. (A) The fluid is in the outer region near the heart (yellow arrow). (B) Doppler mode shows no indication of cardiac disturbance. (C) The viscous mass is in the dexter lung region (red arrow).

CONCLUSION

Cases of pyothorax in 5-year-old male domestic cats with clinical symptoms of lethargy, dyspnea, abnormal lung sounds, laziness of movement, decreased fremitus, pain, and increased resistance of the thoracic wall. The results of imaging with X-ray and ultrasound showed the accumulation of yellow, viscous fluid; coccus bacteria and leukocytes were found.

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