pISSN 1598-298X / eISSN 2384-0749
J Vet Clin 34(6) : 437-440 (2017)
http://dx.doi.org/10.17555/jvc.2017.12.34.6.437

Journal of Veterinary Clinics
www.ksvc.or.kr

Recurrent Pericardial Effusion with Feline Infectious Peritonitis in a Cat

Su-Yeon Baek, Jae-Geum Jo, Kun-Ho Song and Kyoung-Won Seo[1]

College of Veterinary Medicine, Chungnam National University, Daejeon 305-764, Korea

(Received: August 20, 2017 / Accepted: October 11, 2017)

Abstract : A five-month-old, male Domestic Korean shorthair was referred to our hospital with a history of lethargy, anorexia, and globoid cardiac silhouette on thoracic radiography. Physical examination showed dehydration and anemia was revealed on blood analysis. On thoracic radiography and echocardiography, the patient showed pericardial effusion and ultrasound-guided pericardiocentesis was performed. A Rivalta test of the pericardial effusion showed a positive result. As the patient had recurrent pericardial effusion, pericardiectomy was performed. He was tentatively diagnosed with wet form feline infectious peritonitis (FIP) and treated with Polyprenyl immunostimulant (PI). Neurological signs were eventually seen and he was euthanized. Histopathologic changes with markedly expanded neutrophils, lymphocytes, plasma cells, and macrophages with fibrous connective tissue and collagenous fibers were detected. Immunohistochemistry for FIP antigen was performed and results showed FIPV-positive multifocal aggregates of cells. Pericardial effusion is an atypical condition in cats with FIP, but can be presented. This case report describes FIP with pericardial effusion in a cat, in which definitive diagnosis of FIP was done using biopsy via pericardiectomy.

Key words **:** feline infectious peritonitis (FIP), pericardial effusion, pericarditis, pericardiectomy.

Introduction

Pericardial effusion is an accumulation of fluid around the heart which is a rare condition in cats, especially in young cats. The affected age group is reported to be 12 to 17 years with an average of 7.2 years (4,11). Pericardial effusion has been reported in 146 cats, in which common causes include hypertrophic cardiomyopathy (25.3%), neoplasia (19.2%), feline infectious peritonitis (FIP) (9.6%), systemic infection (8.4%), and idiopathic causes (2,4). Most cats with pericardial effusion have pleural effusion or pulmonary edema (4).

Feline infectious peritonitis (FIP) is a well-known, fatal, infectious and immune-mediated disease in cats occurring due to feline coronavirus (FCoV) infection. Two forms of FIP exist, the effusive form and the non-effusive form, each of which can develop into the other (5). The effusive form is typically characterized by fibrinous polyserositis and protein-rich fluid in the pleural and peritoneal cavities, with or without fluid in pericardial cavities (2,5).

This is a rare and atypical case of a five-month-old cat in which the main symptom was pericardial effusion, and which was eventually diagnosed with FIP.

Case

A five-month-old intact male domestic shorthair cat weighing 3 kg was referred for anorexia, lethargy, and globoid cardiac silhouette on thoracic radiography. According to the owner, the symptoms appeared the day before the initial visit. Nasal FIP and all core vaccinations were done.

On physical examination, muffled heart sounds were auscultated and the body condition score was 4/9. The cat was 8-10% dehydrated and had low blood pressure (70 mmHg; reference range, 110-160 mmHg). Blood analysis revealed non-regenerative anemia (25.3%; reference range, 27.7-46.8%) and hyperlactatemia (4.7 mg/dL; reference range, 0.6-2.5). Although the WBC count was within normal limits ($7.6 \times 10/L^9$, reference range, $6.3\text{-}19.6 \times 10^9$), grade III/V toxic change was observed, and lymphopenia was detected (760 cells/μl; reference range, 1500-7000 cells/μl). In the coagulation test, prothrombin time was within reference range (16.7 sec; reference range, 15-22 sec) but activated partial thromboplastin time was over the detection range (over 200 sec, reference range 65-119 sec).

Results of corona virus antibody, feline leukemia virus antigen, feline immunodeficiency virus antibody, and N-terminal prohormone of brain natriuretic peptide (NT-proBNP) tests using serum samples were all negative.

Thoracic radiography showed globoid cardiac silhouette and scalloped sign (Fig 1A). Generalized hepatomegaly was found on abdominal radiography. On abdominal ultrasonography, hyperechoic peritoneum and medullary rim sign in kidneys were detected. Echocardiographic examination revealed pericardial effusion and the pericardium was thickened, but diastolic dysfunction was not detected (Fig 1D, 1E, and 1F). Computed tomography was performed for more information, and pericardial fluid with a small volume of thoracic effusion was found (Fig 1B and 1C). Some lymph nodes in the thoracic cavity and abdominal cavity were enlarged.

Pericardiocentesis was performed for pericardial effusion analysis and relief of clinical symptoms, and approximately 73 ml of serosanguineous pericardial effusion was obtained

[1]Corresponding author.
E-mail : kwseo@cnu.ac.kr

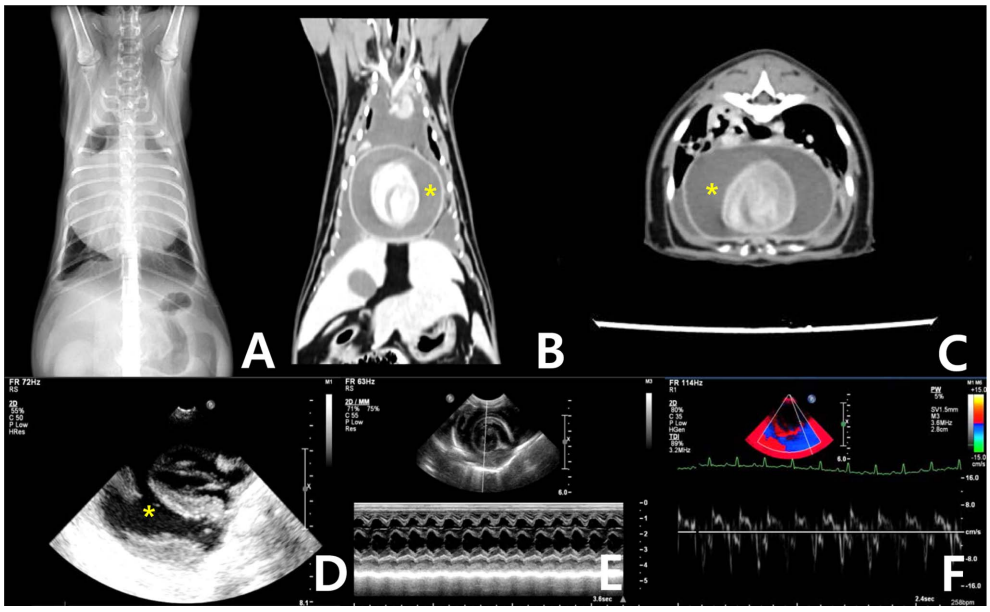

Fig 1. Imaging diagnosis. (A) Ventrodorsal view of the thoracic radiograph shows globoid cardiac silhouette and fissure line. (B) and (C) are thorax soft tissue window post-contrast computed tomography images (B. dorsal reconstruction image; C. transverse image) and excess fluid (yellow stars) has accumulated in the pericardial space surrounding the heart. (D), (E), and (F) show echocardiographic images. Pericardial effusion is detected and diastolic function is normal.

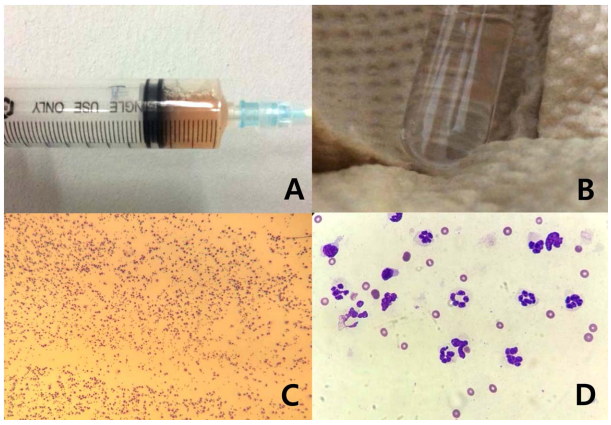

Fig 2. Pericardial effusion examinations. (A) Serosanguineous pericardial effusion. (B) Positive Rivalta test. (C) and (D) are cytologic examination of effusion that shows increased neutrophils (C, × 40 ; D, × 1000). H&E.

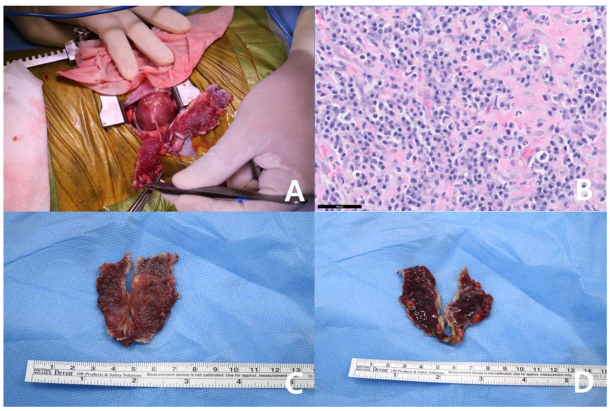

Fig 3. (A) Pericardiectomy through right lateral thoracotomy. Pericardium is thickened (C, inner layer; D, Outer layer). (B) The pericardial wall is markedly expanded due to neutrophils, lymphocytes, plasma cells, and macrophages, with fibrous connective tissue and collagenous fibers. H&E. Bar = 50 μm.

(Fig 2). The total cell count was 19,300 and the predominant cells were neutrophils (85%). Total protein and albumin of the fluid was 6.0 g/dL and 2.2 g/dL, respectively, and the albumin/globulin ratio was 0.57. The Rivalta test was positive and bacteria or neoplastic cells were not detected. A sample analyzed for bacterial culture was negative. A pericardial effusion sample was analyzed by IDEXX laboratory (City, CA, USA) for feline corona virus (FCoV) detection using real time reverse transcription polymerase chain reaction (RT-PCR). The result was positive, but biotyping was a failure due to insufficient viral particles which were below the limit of detection. However, shortly after pericardiocentesis, pericardial fluid re-occurred. At this point, both to make a definitive diagnosis and alleviate recurrent pericardial effusion, partial pericardiectomy was performed. Pericardiectomy through right lateral thoracotomy was done and two-thirds of the pericardium was removed (Fig 3). The pericardium sample was analyzed by IDEXX for histopathology.

Histopathology analysis revealed that the pericardial wall was markedly expanded due to neutrophils, lymphocytes, plasma cells, and macrophages with fibrous connective tissue and collagenous fibers (Fig 3). Based on the clinical signs and histopathologic findings, the patient was suspected to have a mixed type FIP and was examined in the outpatient clinic.

Supportive care was performed including polyprenyl immunostimulant (3 mg/kg, twice a week, PO), antibiotics, and antiemetics. Although clinical signs were relieved, the treatment had to be stopped on the request of the owner. After two

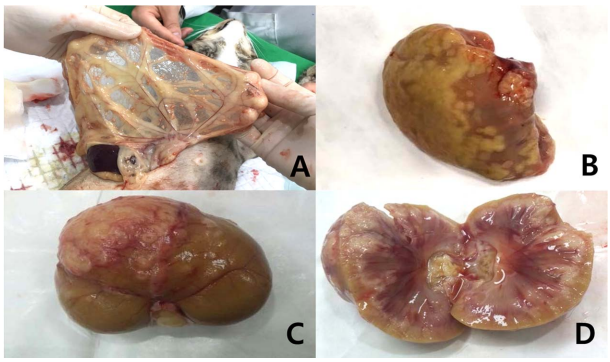

Fig 4. Postmortem appearance. (A) Mesenteric nodes are detected. (B) Multifocal small foci were revealed in the parenchyma of liver. (C), (D) Granulomatous changes in kidney.

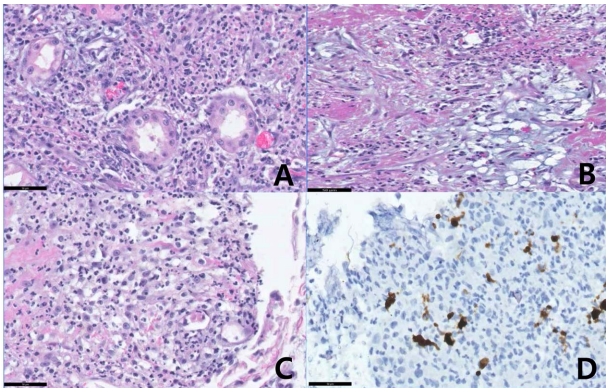

Fig 5. Histopathology and immunohistochemistry results. (A) Multifocal small foci of parenchyma in the cortex and medulla of kidney have small to moderate aggregates of neutrophils, macrophages, lymphocytes, and plasma cells, with fibrin, necrosis, and hemorrhage. (B) Multifocal small foci of liver parenchyma have small aggregates of neutrophils, macrophages, lymphocytes, and plasma cells, with fibrin, necrosis, and hemorrhage. (C) Multiple aggregated nodular structures in mesenteric nodules are composed of large numbers of neutrophils, macrophages, and lymphocytes, with fibrin, and necrosis. (D) Immunohistochemistry demonstrates multifocal aggregates of cells in the pericardium which are FIP-positive (FIPV3-70, 1:1000 dilution). H&E. Bar = 50 μm.

weeks, consistent mydriasis and partial seizure symptoms such as circling and ptyalism were presented. Furthermore, the general condition of the patient was getting worse. The cat was euthanized considering his general status and grave prognosis, and necropsy was performed with the owner's consent.

At necropsy, multifocal small foci were revealed in the parenchyma of liver and kidney (Fig 4). Histopathological changes included aggregates of neutrophils, macrophages, lymphocytes, and plasma cells, with fibrin, necrosis, and hemorrhage in liver and kidney. Pyogranulomatous inflammation in the liver and kidney and pericarditis is highly consistent with FIP. Immunohistochemistry (IHC) for FIPV was performed on samples of pericardium from this cat by IDEXX. Results of the staining showed multifocal aggregates of cells, indicating FIPV-positive status.

Discussion

Clinical signs of FIP are variously presented depending on type of disease and organs involved. Clinical signs and histopathological findings directly result from pathophysiological changes in FIP, developing into vasculitis and damage of blood supply to multiple organs (5). Gross examinations reflect such changes and fibrinous polyserositis, mucinous fluid, and white plaques on various organs are characteristic (8). Cats with non-effusive FIP show perivascular pyogranulomatous changes in many organs and at postmortem examinations, renomegaly, pyogranulomas, and uveitis are detected (8).

Pericardial effusion can be classified based on etiology, similarly as other body effusions (3). Protein concentration and cytology are helpful in supporting further evidence for FIP, and most FIP fluids are modified transudates. However, inflammatory exudates can sometimes be detected as in this case, and should be distinguished from septic exudates (10,15).

Pericardiectomy classified as subtotal or complete is the surgical removal of the pericardium and is indicated in case of cardiac tamponade and recurrent pericardial effusions (13). Recurrent idiopathic pericardial effusion is repeatedly accumulating body fluid in the pericardial sac without heart failure, neoplasia, uremia, or any known reason. Cardiac tamponade occurs when increasing intrapericardial pressure with compression of the heart impairs normal cardiac diastolic function (1). In a state of hypovolemia, cardiac tamponade can be masked (7). Hence, the assessment of diastolic function is imperative. In this case, pericardiectomy was indicated because recurrent pericardial effusion and thickened pericardium was revealed without noticeable cardiac tamponade.

Tentative diagnosis of FIP can be made based on the patient's signalment, history, clinical signs, laboratory changes, fluid examination, imaging impressions, measurement of antibodies, and the result of RT-PCR. RT-PCR can be a reliable test if using body fluid from cats with wet form FIP, and shows high specificity (100%) and sensitivity (85-89%) (12). However, definitive diagnosis antemortem is usually challenging because the golden standard for FIP diagnosis is IHC to detect viral antigen within macrophages, which requires biopsy (8). In this case, FIP was suspected strongly on the basis of age, body cavity effusions with pericardial effusion, low A/G ratio of the serum and effusions, ultrasonographic changes, and pyogranulomatous lesions. Moreover, FCoV was detected in pericardial effusions using RT-PCR and FIP was confirmed using IHC.

The medication used in the patient is PI, which upregulates Th-1. Therefore, it is effective in diseases caused due to depressed cell-mediated immunity (6). This medication was quiet effective on dry form FIP according to a recent study (6). However, no studies on wet form FIP have been reported till date. There are no fully evaluated specific drugs for FIP, and the patient was suspected of mixed type FIP. Therefore, PI was used and the disease progression rate seemed to be slowed.

In case of wet form FIP, survival time is expected to be approximately days to weeks (12). According to an algo-

rithm for the staging of effusive FIP, survival time of cats with effusive FIP can be predicted, especially through a total bilirubin test which is considered the most significant parameter (14). In effusive cases, hyperbilirubinemia tends to be detected before death through serial blood analysis. In our case, at the time the cat was referred, the calculated score was 4 indicating a survival time of more than two weeks. Before he was discharged, mild hyperbilirubinemia was detected (0.34 mg/dL; reference range 0-0.2 mg/dL). However, on the day of subsequent hospitalization with neurologic signs, total bilirubin was significantly elevated (3.09 mg/dL; reference range 0-0.2 mg/dL), and the score was 12 which indicating a survival time of less than three days. Finally, euthanasia was recommended and this patient survived for four weeks from the initial admission at our hospital.

Pericardial effusion in a cat is a rare condition and may appear poorly correlated with FIP. Especially in case of a young cat, FIP should be on a top differential diagnostic list, and pericardiectomy could be considered to relieve clinical signs and define the underlying disease in such cases. In addition, other novel diagnostic techniques by utilization of body fluids or biopsy along with the patient's age and clinical presentations can be useful, since definitive antemortem diagnosis of FIP through general laboratory examinations is challenging.

Acknowledgement

This work was supported by Chungnam National University.

References

1. Bouvy BM, Bjorling DE. Pericardial effusion in dogs and cats. I. Normal pericardium and causes and pathophysiology of pericardial effusion. Compend Contin Educ Pract Vet 1991; 13: 417-421.
2. Davidson BJ, Paling AC, Lahmers SL, Nelson OL. Disease association and clinical assessment of feline pericardial effusion. J Am Anim Hosp Assoc 2008; 44: 5-9.
3. Dempsey SM, Ewing PJ. A review of the pathophysiology, classification, and analysis of canine and feline cavitary effusions. J Am Anim Hosp Assoc 2011; 47: 1-11.
4. Hall DJ, Shofer F, Meier CK, Sleeper MM. Pericardial effusion in cats: a retrospective study of clinical findings and outcome in 146 cats. J Vet Intern Med. 2007; 21: 1002-1007.
5. Hartmann K. Feline infectious peritonitis. Vet Clin North Am Small Anim Pract 2005; 35: 39-79.
6. Legendre AM, Kuritz T, Galyon G, Baylor VM, Heidel RE. Polyprenyl immunostimulant Treatment of cats with Presumptive non-effusive Feline infectious Peritonitis in a Field study. Front Vet Sci 2017; 4: 7.
7. Madron E, Chetboul V, Bussadori C. Pericardial diseases. In: Clinical Echocardiography of the Dog and Cat, 1st ed. St Louis: Saunders Elsevier. 2015: 260-269.
8. Oliveira LB, Susta L, Rech RR, Howerth EW. Pathology in Practice. J Am Vet Med Assoc 2014; 245: 899-901.
9. Pedersen NC. A review of feline infectious peritonitis virus infection: 1963-2008. J Feline Med Surg 2009; 11: 225-258.
10. Pedersen NC. An update on feline infectious peritonitis: diagnostics and therapeutics. Vet J 2014; 201: 133-141.
11. Rush J, Keene B, Fox P. Pericardial disease in the cat: a retrospective evaluation of 66 cases. J Am Vet Med Assoc 1990; 26: 39-46.
12. Saunders S. An update on feline infectious peritonitis: Companion Animal FIP MCQS. COAN CPD. 2016; 21: 472-478.
13. Tobias KM, Johnston SA. Pericardial surgery. In: Veterinary Surgery: Small Animal, 1st ed. St Louis: Saunders Elsevier. 2013: 1845-1853.
14. Tsai HY, Chueh LL, Lin CN, Su BL. Clinicopathological findings and disease staging of feline infectious peritonitis: 51 cases from 2003 to 2009 in Taiwan. J Feline Med Surg 2011; 13: 74-80.
15. Zoia A, Slater LA, Heller J, Connolly DJ, Church DB. A new approach to pleural effusion in cats: markers for distinguishing transudates from exudates. J Feline Med Surg 2009; 1: 847-855.