ATATÜRK ÜNİVERSİTESİ YAYINLARI
ATATURK UNIVERSITY PUBLICATIONS

Case Report *Olgu Sunumu* DOI: 10.5281/zenodo.12577779

# Successful Management of Cardiogenic Thromboembolism in a Cat

## Bir Kedide Kardiyojenik Tromboembolinin Başarılı Yönetimi

Tuğçe ÇAKIR[1*]
Mehmet DÖRTERLER[1]

[1]Ata Pet Animal Hospital, Menteşe, Muğla, TÜRKİYE

**ABSTRACT**

Cardiogenic arterial thromboembolism (CATE) is a critical and often life-threatening condition seen in both human and veterinary medicine. Cats with underlying cardiac conditions are predisposed to developing intracavitary thrombi due to hypertrophic cardiomyopathy (HCM). A two-year-old Scottish Fold neutered male cat presented to Atapet Animal Hospital with acute dyspnea. The patient was found to be tachypneic and tachycardic. Latero-lateral radiographic evaluation indicated pulmonary edema, and a ventro-dorsal view demonstrated a valentine heart shape, while echocardiography demonstrated a significantly enlarged left atrium, a "smoke" appearance suggestive of blood stasis, and an accompanying atrial thrombus, along with increased left ventricular wall thickness and pericardial effusion. Subsequent echocardiographic evaluations on the 3rd and 30th days post-treatment demonstrated absence of thrombus, resolution of tachycardia, and overall improvement in clinical status. Echocardiographic examinations were crucial for the early diagnosis of CATE and HCM, and starting treatment with heparin derivatives and then clopidogrel helped manage CATE.

**Keywords:** Cardiogenic thromboembolism, Cat, Successful management

**ÖZ**

Kardiyojenik arteriyel tromboembolizm (CATE), hem insan hem de veteriner hekimliğinde görülen kritik ve sıklıkla yaşamı tehdit eden bir durumdur. Altta yatan kalp rahatsızlığı olan kediler, hipertrofik kardiyomiyopatiye (HCM) bağlı olarak intrakaviter trombüs geliştirmeye yatkındır. İki yaşında Scottish Fold kısırlaştırılmış erkek kedi, akut nefes darlığı şikayetiyle Atapet Hayvan Hastanesi'ne başvurdu. Hastanın taşipneik ve taşikardik olduğu belirlendi. Latero-lateral radyografik değerlendirme pulmoner ödemi gösterdi ve ventro-dorsal görünümde sevgililer günü kalp şekli görüldü; ekokardiyografide ise sol atriyumda belirgin bir genişleme, kan stazını düşündüren bir "duman" görünümü ve buna eşlik eden atriyal trombüs ile birlikte sol atriyumda artış görüldü. ventriküler duvar kalınlığı ve perikardiyal efüzyon. Tedaviden sonraki 3. ve 30. günlerde yapılan ekokardiyografik değerlendirmelerde trombüs olmadığı, taşikardinin düzeldiği ve klinik durumda genel iyileşme olduğu görüldü. CATE ve HCM'nin erken tanısı için ekokardiyografik incelemeler çok önemliydi ve heparin türevleri ve ardından klopidogrel ile tedaviye başlanması, CATE'nin yönetilmesine yardımcı oldu.

**Anahtar Kelimeler:** Başarılı Yönetim, Kardiyojenik Tromboembolizm, Kedi

**Geliş Tarihi/Received** 27.05.2024
**Revizyon/Revision** 07.06.2024
**Kabul Tarihi/Accepted** 26.06.2024
**Yayın Tarihi/Publication Date** 30.06.2024

**Sorumlu Yazar/Corresponding author:** Tuğçe ÇAKIR
**E-mail:** tgccakir95@gmail.com
**Cite this article:** Çakır T, Dörterler M. Successful Management of Cardiogenic Thromboembolism in a Cat. *J Vet Case Rep*. 2024;4(1):14-18.

## INTRODUCTION

Cardiogenic arterial thromboembolism is a critical and often life-threatening condition seen in both human and veterinary medicine.[1] Despite its severity, successful management strategies remain limited, particularly in feline patients.[2-4] These events are termed cardiogenic due to their origin in a cardiac chamber, typically the left auricle. They are closely linked with underlying myocardial diseases, encompassing a spectrum that includes hypertrophic cardiomyopathy (HCM), dilated cardiomyopathy, restrictive cardiomyopathy, and unclassified/ischemic cardiomyopathy.[5-9] Cats with underlying cardiac conditions are predisposed to developing intracavitary thrombi due to factors encompassed by the Virchow triad: blood stasis, endothelial injury, and a potential hypercoagulable state.[10] When left ventricular function is impaired, it can lead to left atrial dilation and dysfunction in the left auricle, promoting blood stasis.[11] This stasis is often detectable on echocardiograms as spontaneous contrast, colloquially referred to as "smoke".[11-13] Moreover, the gold standard test for diagnosing HCM is echocardiography[14], and many of the most important prognostic markers in these domestic felines are echocardiographic variables.[15] Asymptomatic HCM is common, affecting approximately 15% of apparently healthy cats and up to 25% of cats older than 9 years.[14] Therefore, it is very important to screen cats for probable asymptomatic HCM by echocardiography, especially the younger ones. This case report presents a successful approach to the management of cardiogenic thromboembolism in a domestic cat. Through a combination of prompt diagnosis, aggressive treatment, and meticulous care, the feline patient not only survived this acute cardiac event but also demonstrated remarkable recovery and long-term stability. The case highlights the importance of early recognition, multidisciplinary collaboration, and tailored therapeutic interventions in achieving favorable outcomes in feline CATE cases.

## CASE PRESENTATION

A two-year-old Scottish Fold neutered male cat, who had no previous illness, was presented to Atapet Animal Hospital with a complaint of acute dyspnea. The patient was found to be tachypneic (40 breaths per minute) and tachycardic (210 beats per minute) and had no neurological findings. However, a complete blood examination revealed no abnormalities (Table 1), latero-lateral radiographic evaluation indicated pulmonary edema (Figure 1), and a ventro-dorsal view demonstrated a valentine heart shape (Figure 2), while echocardiography demonstrated a significantly enlarged left atrium, a "smoke" appearance (Figure 3), suggestive of blood stasis, and an accompanying atrial thrombus (Figure 3), alongside increased left ventricular wall thickness and pericardial effusion (Figure 4).

***Table 1.*** *Haematological parameters of cat with CATE.*

| Parameters | Result | Reference value |
|---|---|---|
| **WBC (x10³/µL)** | 12.26 | 3.5 – 17.5 |
| LYM (x10³/µL) | 1.31 | 0.7 – 7.4 |
| MON (x10³/µL) | 0.12 | 0.1 – 1.0 |
| **NEU (x10³/µL)** | 10.68 | 2.0 – 11.5 |
| EOS (x10³/µL) | 0.14 | 0.0 – 1.5 |
| BAS (x10³/µL) | 0.01 | 0.0 – 0.3 |
| **RBC (x10⁶/µL)** | 8.46 | 6.3 – 11.8 |
| **HGB (g/dL)** | 10.9 | 9.0 – 16.0 |
| **HCT (%)** | 34.8 | 26.0 – 50.2 |
| **PLT (x10³/µL)** | 154 | 140 – 595 |

***Figure 1.*** *Pulmonary edema in the latero-lateral radiographic view of the cat.*

***Figure 2.*** *The valentine heart shape in the ventro-dorsal radiographic view of the cat.*

The vertebral heart score (VHS) is only 51% accurate in cat radiography.[15] Therefore, VHS was not measured, and echocardiography, which is considered the gold standard in the diagnosis of HCM, was used. Echocardiography was performed using the Mindray VETUS-8 echocardiography scanner. The left atrial (LA)-to-aortic (Ao) diameter ratio

(LA/Ao) was measured in the right parasternal short-axis view at the level of the basal heart (Table 2). The end-diastolic interventricular septal thickness (IVSd), LV end-diastolic internal diameter (LVIDd), LV end-diastolic posterior wall thickness (LVPWd), LV end-systolic interventricular septal thickness (IVSs), LV end-systolic internal diameter (LVIDs), LV end-systolic posterior wall thickness (LVPWs), and fractional shortening (FS) were measured in the right parasternal short-axis view at the level of the chordae tendineae (Table 2).

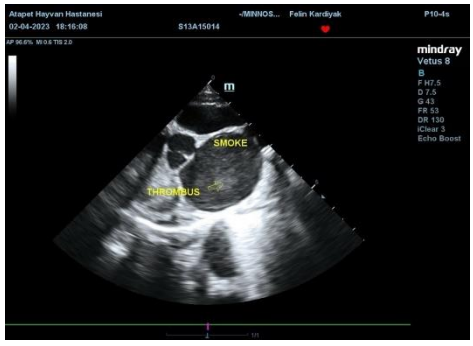


***Figure 3.*** *Smoke and thrombus appearance in the left atrium before the treatment on day one.*


***Figure 4.*** *Pericardial effusion appearance in the left atrium before the treatment on day one.*

***Figure 5.*** *The left atrium view of the cat on day three after treatment.*

Based on the clinical symptoms, radiographic (Figure 2), and echocardiographic examinations (Table 2), HCM with a cardiogenic thrombus was diagnosed in the patient. Blood gas analysis could not be performed on the patient due to the inability of the patient's owner to meet the budget due to the high treatment costs. After informed consent was obtained, treatment was started with oxygen administration, and oxygen administration was continued throughout the treatment. Because the patient was tachycardic, diltiazem (0.25 mg/kg PO, BID, 30 days), a negative inotropic agent approved for use in cats with HCM, was started. Furosemide (1 mg/kg IV, 3 days) was started for the treatment of pulmonary edema because it reduces the pressure caused by excess fluid in the lungs. According to Bonagura (2), sodium heparin was initially administered at 100 IU/kg IV, diluted with 10 ml of saline on the first day, followed by subsequent subcutaneous injections of 200 IU/kg once every 8 hours on the second day. The furosemide application was continued for 3 days. By the third day of treatment, control echocardiography revealed dissolution of the atrial thrombus (Figure 5) and decreased "smoke" appearance, prompting the initiation of clopidogrel at 18.75 mg/cat PO every 24 hours. More frequent checks could not be carried out due to the financial concerns of the patient owner. Therefore, echocardiographic evaluations performed on the 3$^{rd}$ and 30$^{th}$ days after treatment showed that there was no thrombus, tachycardia improved, and there was a general improvement in the clinical condition. Moreover, at the 1-month follow-up, clinical and echocardiographic examinations revealed successful management of the cardiogenic thromboembolism in the presented case.

***Table 2.*** *M-mode echocardiographic indices in the presented case and reference ranges*[25]

| Parameter | Presented case measurements | Reference ranges |
|---|---|---|
| **LA (mm)** | **17.9** | 7-14 |
| **Ao (mm)** | 8.3 | 8-11 |
| **LA/Ao** | **2.15** | ≤1.6-17 |
| **IVSd (mm)** | **7** | ≤5.5 |
| **LVIDd (mm)** | 12.1 | 12-18 |
| **LVPWd (mm)** | **9.8** | ≤5.5 |
| **IVSs (mm)** | 8.1 | ≤9 |
| **LVIDs (mm)** | **3.9** | 5-10 |
| **LVPWs (mm)** | **12.6** | ≤9 |
| **FS (%)** | **67.44** | 35-65 |

## DISCUSSION

Cardiogenic arterial thromboembolism poses a significant threat in feline cardiomyopathy, where fragments of intracavitary thrombi can obstruct distant arteries, resulting in tissue damage or organ infarction.[6] Paraplegia, paralysis, and severe pain have been reported in ATE cases. Additionally, tachypnea (91%), hypothermia (66%), and loss of limb motor function (66%) were commonly observed in cats with ATE.[16] In this case, emergency treatment was started when the patient came with only a complaint of dyspnea and tachypnea and a thrombus was detected in the left atrium on echocardiography. Thus, clinical findings such as paraplegia and paralysis due to CATE were not observed. In a study, when the underlying diseases were investigated in 127 cats with ATE, it was observed that the most common causes were cardiac in origin and were classified as dilated, unclassified, hypertrophic obstructive, and hypertrophic cardiomyopathy. It has been reported that one of the most common causes is hypertrophic cardiomyopathy.[16] Similarly, a thrombus mass was detected in the left atrium of the cat in this case, and HCM was detected in the cat as a result of echocardiographic measurements.

The reported prevalence of ATE in cats is approximately 0.3% in general practice and 0.6% in the referral population.[16,17] Two large studies found that 9% to 11% of cats with HCM developed ATE.[16,18] The mean or median age at presentation with ATE is 8–12 years, with a range of 0.1–21 years.[16,17] On the other hand, the incidence of ATE in young cats with HCM (<2.5 years) was reported to be only 0.7% in a large, multicenter study.[19] In this case report, the patient was only 2 years old. The diagnosis of a disease that is very rare at this age can be based on the use of echocardiography, as seen in this case. As a matter of fact, a thrombus in the left atrium was detected by echocardiography performed on the patient who complained of dyspnea, and the disease could be diagnosed before the clinical findings progressed.

Unfortunately, effective strategies to prevent recurrent CATE are lacking, often leading to euthanasia as the chosen course of action.[20] Antithrombotic drugs are the standard of care for cardioembolic prevention in humans[21] and have been incorporated into clinical protocols for cats.[22] Optimising medical management is crucial to prevent intracardiac thrombosis and subsequent ATE in at-risk cases or recurrence in post-ATE cases, as cats with HCM are at high risk of this condition. According to recent consensus guidelines on feline cardiomyopathies from the American College of Veterinary Internal Medicine, clopidogrel, an antiplatelet medication, should be started when there are echocardiographic risk factors.[23] Early heparinization and subsequent use of oral clopidogrel, as in this case, were found to be effective in the treatment. Similarly, in their study, Lo et al.[24] used clopidogrel and rivaroxaban in the treatment of cats with ATE. They reported that dual antithrombotic therapy resulted in fewer side effects, a lower relapse rate, and provided effective thromboprophylaxis in cats with intracardiac thrombus or spontaneous echocardiographic contrast.

As a result, HCM should be suspected in cats with respiratory emergencies, especially shortness of breath, echocardiography should be performed as soon as the patient calms down, and the left atrium should be evaluated for a possible thrombus. It was observed that echocardiographic examinations played a very important role in the early diagnosis of CATE and HCM, and that starting treatment with heparin derivatives and then using clopidogrel provided beneficial results in the management of CATE.

**Hakem Değerlendirmesi:** Dış bağımsız.
**Yazar Katkıları:** *[Tuğçe ÇAKIR (TÇ), Mehmet DÖRTERLER (MD]: Fikir-TÇ,MD; Tasarım-TÇ,MD; Denetleme-TÇ,MD; Kaynaklar-TÇ,MD; Veri Toplanması ve/veya İşlemesi-TÇ,MD; Analiz ve/ veya Yorum-TÇ,MD; Literatür Taraması-TÇ,MD; Yazıyı Yazan-TÇ,MD; Eleştirel İnceleme-TÇ,MD*
**Çıkar Çatışması:** Yazarlar, çıkar çatışması olmadığını beyan etmiştir.
**Finansal Destek:** Yazarlar, bu çalışma için finansal destek almadığını beyan etmiştir.

**Peer-review**: Externally peer-reviewed.
**Author Contributions:** *[Tuğçe ÇAKIR (TÇ), Mehmet DÖRTERLER (MD]:* Concept -TÇ,MD; Design-TÇ,MD; Supervision-TÇ,MD; Resources-TÇ,MD; Data Collection and/or Processing-TÇ,MD; Analysis and/or Interpretation-TÇ,MD; Literature Search-TÇ,MD; Writing Manuscript-TÇ,MD; Critical Review-TÇ,MD
**Conflict of Interest:** The authors have no conflicts of interest to declare.
**Financial Disclosure:** The authors declared that this study has received no financial support.

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