

# Abnormal Morphology: Mitral Dysplasia in a Cat

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## Abstract

Mitral dysplasia is a pathology that describes abnormal mitral valve and valve-related structures. This congenital disease, which has been diagnosed increasingly with advancing technology, creates congestive heart failure when it progresses. Although echocardiography is accepted as the primary standard at the diagnosis stage, it may not be sufficient alone, and advanced tests may be required. The prognosis of the patients is poor. A two-month-old, mixed breed, female cat has respiratory problems and anorexia symptoms. The patient, who was taken to two different clinics, was diagnosed with bronchitis. Our hospital revealed that the diagnosis was not bronchitis but congestive heart failure due to mitral dysplasia. Medical treatment was applied to reduce the symptoms in the patient. Two days after the start of the medication, the patient began to eat and was significantly active. After the patient was stabilized, the patient was handed over to the owner in order to avoid nosocomial infections and to minimize stress. There was no further news from the patient. This is the first case reported for this disease in our country. It is also important because it is a case that reveals the importance of the multisystemic approach.

## Keywords

Anomaly, Cat, Congenital, Dysplasia, Echocardiography

## 1. Introduction

Mitral valve dysplasia is one of the common congenital malformations in cats. The mitral valve and other structures associated with mitral valve (chordae tendineae, papillary muscles) can't complete their normal development. They are smaller than usual and in irregular form. The prevalence of congenital heart defects in cats is 0.2%. Mitral dysplasia is the second most common anomaly in

cats. Abnormal growth may occur in the chordae tendineae or other structures associated with the valves. These abnormalities in the valves prevent complete closure, resulting in an abnormal transmitral and regurgitant flow profile [1]. Poor cardiac output can result in inadequate tissue oxygenation, resulting in syncope. The patient develops signs of congestive heart failure. Although the prognosis varies according to the severity of the malformation, it is generally poor. Patients should be treated for heart failure [2]. The radiograph shows high vertebral heart scale. In echocardiography: malformations, degenerations, abnormally thick chordae tendineae, and regurgitation profiles can be revealed in the valves. Left atrial size is an essential parameter for prognosis. Regurgitating blood will cause dilatation of the left atrium. Mitral dysplasia symptoms: manifest as difficulty in breathing, exercise intolerance, and cough. Cyanosis, murmur, and arrhythmias are the most common clinical findings [2]. Congenital anomalies may be associated with other defects. One study described cats' ventricular septal defect with a double outlet ventricle. In some cases, it may occur as part of Fallot's tetralogy [3]. In a case report, abnormal chordae tendineae and mitral dysplasia were diagnosed together. Postmortem examination revealed hypertrophy due to regurgitation caused by dysplasia, microscopically and macroscopically [4]. The prognosis is generally poor, and sudden death is possible [1]. This study emphasizes that congenital heart diseases are more common in cats than is thought and the importance of a multisystemic approach in the diagnosis stage. Conditions that appear to be respiratory tract infections encountered in routine clinical practice in patients may be caused by heart disease. General clinical examination and multisystemic approach are critical in diagnosis.

## 2. Case Description

Our case is a 2-month-old female mix-breed cat brought to our clinic with complaints of loss of appetite, weakness and respiratory distress. Our patient, who was previously taken to two veterinary clinics, diagnosed with bronchitis, and administered antibiotics and antiparasitic drugs, was brought to our hospital when his complaints did not resolve. Firstly, oxygen therapy was applied to our patient with respiratory stress in an incubator at optimal temperature. When our patient became more stable in terms of breathing, a general physical examination was performed. In this context, submandibular lymphadenomegaly and 5% - 7% dehydration rate were detected in the patient with depressed and abdominal breathing. There is a loud rubbing sound on lung auscultation and a grade 4/6 holosystolic murmur in the left apex region. The patient's heart rate is 160/minute, body temperature is 38.1 degrees, and respiratory rate is 48/minute. Since the patient was dehydrated and under respiratory stress, blood could not be drawn and biomarker evaluation could not be performed. Doppler blood pressure measurement method was used in the blood pressure measurement of our patient according to ACVIM (American College of Internal Medicine), blood pressure was measured. For measurement variations, 5 - 7 measurements were made, and

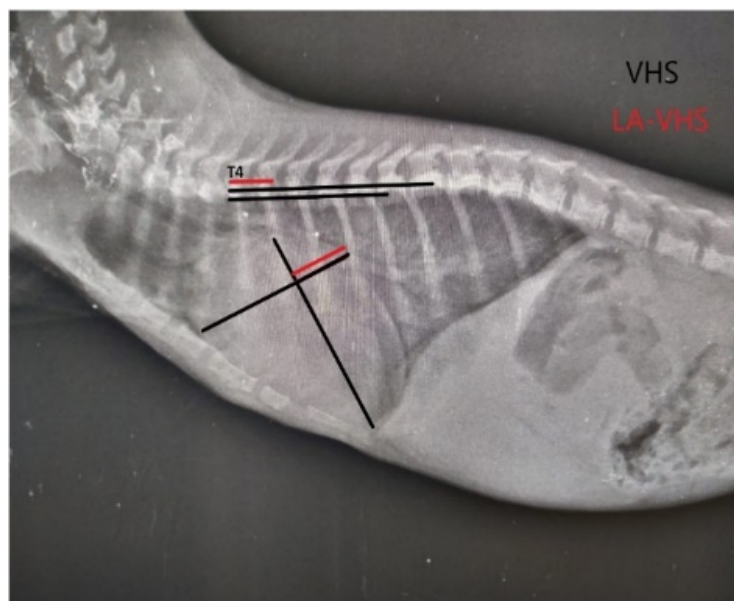
systolic blood pressure was measured as 160 mm Hg. Abnormal size of the heart and severe pulmonary edema was noted on radiographic imaging. Vertebral heart score and left atrial vertebral heart size were measured. In our case, the Vertebral Heart Scale was measured as 10.8 vertebrae. Left atrial vertebral heart scale was measured as 1.70 in our case. In our patient's ECG, an increase in P wave amplitude, increase in P wave width, increase in QRS amplitude, increase in QRS width, and decrease in QT duration were observed. Echocardiography was performed in the right parasternal position of our patient. Echocardiographic examinations of 2D, M Mode, Color Doppler, Pulse-wave Doppler, and Continuous Wave Doppler (Esaote Mylab5 Ultrasonography Device) were applied to our patient, respectively. Due to the respiratory problem, the examination windows and the cursor angle could not be kept at the desired level. Despite this, severe mitral regurgitation was noticeable on the Color Doppler examination. In the 2D echocardiography of the patient, it was revealed that the valve structures were highly dysplastic. Although the cursor is not fully angled in Continuous Wave Doppler, a regurgitant flow profile at a speed of 3.49 m/s has been. The LA/Ao value was found to be 3.79. Left ventricular measurement values revealed by M Mode section taken from right parasternal 2-chamber view, respectively: RVDd 2.6 mm, IVSd 2.9 mm, LVDd 13.3 mm, PWd 2.2 mm, IVSs 3.1 mm, LVDs 10.4 mm, PWs 2.4 mm, EF 49%, FS 22%, La/Ao: 3.79 mm. In our patient with severe regurgitation (3.49 m/s), a positive dp/dt value was found to be 838.6 mmHg/s (significantly lower) despite the regurgitation profile that could not be taken at the right angle due to her general condition. Medical treatment was applied to reduce the symptoms in the patient. For this reason; Pimobendan 0.3 mg/kg PO BID (Vetmedin 5 mg tablet, Boehringer Ingelheim/Germany), Enalapril 0.5 mg PO BID (Enapril 20 mg tablet, Sandoz/Switzerland), Propranolol 5 mg/cat PO BID (Dideral 40 mg tablet, Sanofi/France), Furosemide 4 mg/kg iv just one dose and after that 2 mg/kg PO BID (Lasix 20 mg/2mL injectable solution ampoule, Sanofi Aventis/France, Lasix 40 mg tablet, Sanofi Aventis/France) was used. Two days after the start of the medication, the patient began to eat and was significantly active. On the second day of the hospitalization, the patient was delivered to the owner in a standing position, with an appetite to protect him from nosocomial infections and minimize stress. Afterward, there was no news from the patient.

### 3. Discussion

Congenital heart diseases in cats and dogs; are some defects that have become more frequently diagnosed with the development of technology and opportunities. These defects are; intra and extracardiac shunts, abnormal valve morphologies, and vascular malformations. These defects, which can be of varying prevalence and may be single or multiple during the development of the heart structure, cause different clinical symptoms according to their severity. When left untreated or when the time for intervention has passed, it leads to congestive

heart failure [1] [3] [4] [5] [6] [7].

Murmurs may be found in the clinical examination of the patients. Inaudible murmurs do not rule out a heart problem in the patient [8] [9] [10]. Cardiac biomarkers that are widely used today. Troponin I and Nt-proBNP, can be used to assess heart muscle injury. However, hormones alone are not sufficient for diagnosis. Even if the degree of heart failure is evident, it can be found in normal reference values [1] [9]. Blood pressure measurement is an essential clinical examination standard in veterinary medicine and human medicine. Systolic blood pressure, generally measured by Doppler blood pressure method [11] [12]. Systolic blood pressure was measured as 160 mmHg. This value is considered hypertensive according to ACVIM standards, and antihypertensive medication is recommended [11]. For this reason, our patient was administered Beta Blocker Propranolol 0.5 mg/kg PO BID and ACE inhibitor Enalapril 0.5 mg kg BID. Heart problems change the radiographic cardiac silhouette. There are many methods to measure the size of the heart. One of these methods is the Vertebral Heart Scale. The vertebral heart scale is an objective measurement method. Average values in cats are between 7.5 - 9.5 vertebrae. Radiographic left atrial vertebral size measurement is another measurement method. With this measurement method, atrial dilatation can be interpreted [5] [13] [14]. The vertebral heart scale and left atrial vertebral heart scale were significantly higher in our case. As shown in **Figure 1**, both values were higher than normal. Electrocardiographic examination (ECG) is a useful routine examination method for detecting conduction disorders of the patient. ECG is taken from the patient in the right parasternal or standing position. In mitral valve dysplasia, prolonged P wave duration and shortening amplitude may result from atrial remodeling due



**Figure 1.** Vertebral Heart Size (VHS) and Left-Atrial Vertebral Heart Size (LA-VHS) Measurement in a two-month-old female mix-breed cat (Reference Line 4. Thoracal Vertebrae, Black Color: Vertebral Heart Size, Red Color: Left Atrial Vertebral Heart Size).

to regurgitant flow. Atrial fibrillation or atrial premature complex formation may be observed [1]. Electrocardiography of the patient was measured in the right lateral position with a telemetric ECG device (Kruuse Telemetric Ecg & Holter) at a rate of 10 mm/mV and 25 mm/s. Our patient ECG, had prolonging P wave duration indicates atrial dilatation and slowed ventricular contraction. As shown in **Figure 2** and **Table 1**. Echocardiography in mitral dysplasia; presents as abnormal mitral valve morphology. Dysplasia has impaired the general structure and function of the valves. Abnormal growths may have occurred in the chordae tendinea or the papillary muscles associated with the valves [1] [15]. The left atrium/aorta ratio in echocardiography is a prominent indicator of atrial dilatation. The cutoff value of La/Ao ratio is a maximum of 1.7 mm [2] [16]. In our patient, an image was taken with the M Mode echocardiographic technique, with the cursor centered on the left coronary cuspid and left atrium



**Figure 2.** Telemetric ECG of our patient (Goldberger I, 10 mm/mV, 25 mm/s, six derivation).

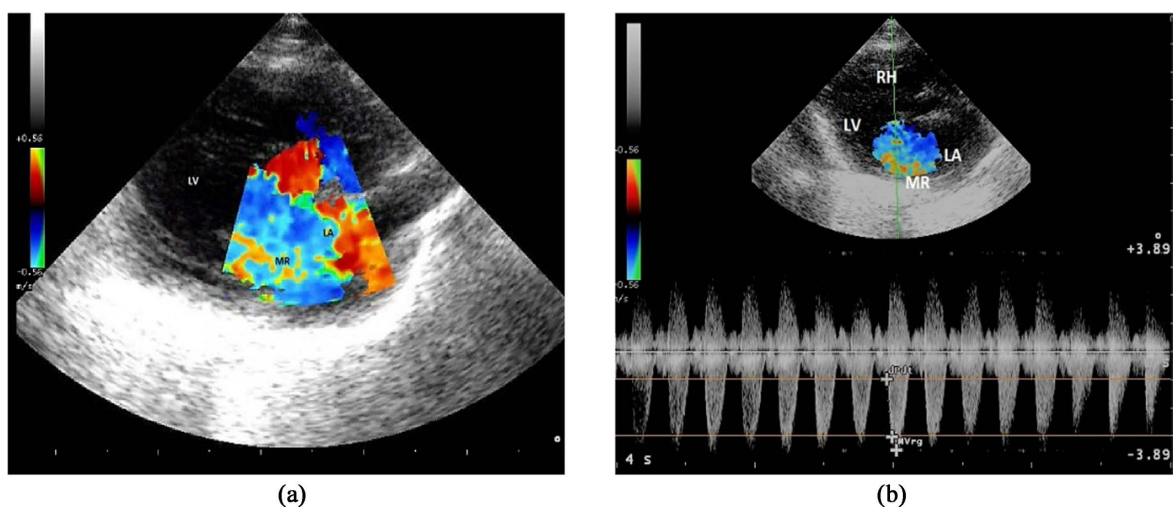
**Table 1.** Electrocardiographic values.

Heart Rate (beat/minute)	160
P Wave Amplitude (mV)	0.2 (h)
P Wave Width (ms)	42 (h)
PR Interval (ms)	83
QRS Amplitude (mV)	1 (h)
QRS Width (ms)	40 (h)
QT Duration (ms)	82 (l)
QT(c) (ms)	98
ST Segment	normal
T Wave Amplitude (mV)	0.2

[16] [17]. Our case La/Ao ratio found to increased. Some of the parameters that measure myocardial function may be affected by blood volume. The  $dp/dt$  value, expressed by dividing the peak rates of left ventricular pressure increase and decrease by the relaxation time, is a method considered the gold standard in the evaluation of myocardial function [18]. In a study, a positive  $dp/dt$  value was defined as maximal  $\geq 2260$  mmHg/s and negative  $dp/dt$  value as maximal  $\leq 1875$  mmHg/s in healthy cats. In addition, positive and negative  $dp/dt$  values decreased significantly in cats with cardiomyopathy [19]. As shown in **Figure 3**, in our patient, a positive  $dp/dt$  value was found to be significantly lower despite the regurgitation profile that could not be taken at the right angle due to her general condition. Although the routine echocardiographic examination is beneficial in differential diagnosis, it may not be sufficient on its own when it comes to complex problems [13] [20] [21].

#### 4. Conclusion

As a result, the patient's prognosis is poor. No surgical intervention can be performed at this stage; medical treatment (Pimobendan 0.3 mg/kg PO BID (Vetmedin 5 mg tablet, Boehringer Ingelheim/Germany), Enalapril 0.5 mg PO BID (Enapril 20 mg tablet, Sandoz/Switzerland), Propranolol 5 mg/cat PO BID (Dideral 40 mg tablet, Sanofi/France), Furosemide 4 mg/kg iv just one dose and after that 2 mg/kg PO BID (Lasix 20 mg/2mL ampoule containing solution for injection, Sanofi Aventis/France, Lasix 40 mg tablet, Sanofi Aventis/France) is recommended [20] [21]. This is the first case reported in our country as an example of mitral dysplasia and related severe mitral regurgitation in a two-month-old kitten. It is also a case report showing how important the multisystemic examination approach is for our patients and emphasizing that congenital diseases in kittens should not be ignored.



**Figure 3.** (a) Advanced Mitral Regurgitation caused by Mitral Dysplasia. (LV: Left Ventricle, LA: Left Atrium, MR: Mitral Regurgitation, (b) Mitral regurgitation, M Mode echocardiography  $dp/dt$  measurement (mitral regurgitant flow: 3.49 m/s,  $dp/dt$ : 838.6 mmHg/s).

## Statements

The owners of this patient have given permission for the case report to be published.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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