

## Diaphragmatic hernia and its treatment in a stray dog

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Received 01.10.2022 - Accepted 02.12.2022 - Published 31.12.2022

**Abstract:** In this case report, it was aimed to share a case of diaphragmatic hernia and its treatment in a 5-month-old female stray dog. In the clinical examination of the patient, dyspnea and ecchymosis in the mucous membranes were detected, while the diaphragm border was not clearly seen in the radiographic examination. The dog was diagnosed with diaphragmatic hernia. It was determined that the dog who underwent herniorrhaphy operation recovered rapidly in the postoperative period.

**Keywords:** Canine, diaphragmatic hernia, dyspnea, herniorrhaphy, trauma.

### Bir sokak köpeğinde diyafram fıtığı ve tedavisi

**Özet:** Bu olgu sunumunda, 5 aylık, dişi bir sokak köpeğinde karşılaşılan diyafram fıtığı olgusu ve tedavisinin paylaşılması amaçlandı. Hastanın klinik muayenesinde dispne ve mukozalarda ekimoz tespit edilirken, radyografik muayenesinde diyafram sınırının belirgin şekilde görülmediği belirlendi. Köpeğe diyafram fıtığı teşhisi konuldu. Herniorafi operasyonu yapılan köpeğin postoperatif dönemde hızla iyileştiği belirlendi.

**Anahtar kelimeler:** Köpek, diyafram fıtığı, dispne, herniorafi, travma.

### Introduction

Diaphragmatic hernia is a health problem with a high mortality rate in which abdominal organs pass into the chest cavity due to ruptures in the diaphragm tissue. Diaphragmatic hernia, which is mostly caused by trauma, causes important clinical symptoms (Radlinsky & Fossum, 2013; Hunt & Johnson, 2012; Ozer et al., 2007; Park & Lee, 2018; Yaygingul et al., 2019; Zamirbekova et al., 2020). The center of the diaphragm, which has a musculotendinous structure, is more durable than its peripheral parts. Therefore, abnormal openings on the diaphragm mostly occur in the region of attachment of the diaphragm to the ribs (Zamirbekova et al., 2020).

Although diaphragmatic hernia can occur congenitally in cats and dogs, it mostly occurs due to blunt trauma (Radlinsky & Fossum, 2013; Hyun, 2004; Yaygingul et al., 2019; Zamirbekova et al., 2020). Diaphragmatic hernias are caused by 85% traumatic reasons, 5-10% congenital, 10-15% unknown reasons (Park & Lee, 2018). The most frequently herniated organs in diaphragmatic hernia cases are liver (64-82%), stomach (47-56%), omentum (26-

44%) and pancreas (4-8%). In hernias formed on the left side of the diaphragm, mostly stomach, spleen and small intestines pass into the chest cavity. In hernias that occur on the right side of the diaphragm, mostly the liver, small intestine and pancreas pass into the chest cavity (Zamirbekova et al., 2020).

In cases of diaphragmatic hernia, the severity of the symptoms may differ according to the condition of the organs displaced into the thorax. The most obvious clinical finding in patients with diaphragmatic hernia is respiratory depression due to pressure on the lungs. Cats and dogs with dyspnea and exercise intolerance due to respiratory depression usually take a dog-sitting position in order to reduce the pressure on their lungs. In cases where the stomach and intestines pass into the thorax, digestive system symptoms such as loss of appetite, vomiting, diarrhea, constipation can also be seen. On physical examination, muffled heart sounds and decreased lung sounds are detected on auscultation of the thorax, while abdominal palpation may reveal that the organs are not in the abdominal cavity. The most common laboratory findings in diaphragmatic hernia in cats and dogs are increased alanine aminotransferase activity and serum calcium concentration (Burns et al., 2013; Nikiphorou et al., 2016).

Direct and indirect radiography is required for the definitive diagnosis of diaphragmatic hernia. The most prominent radiographic findings are the absence of the diaphragm line, the silhouetted appearance of the heart, the displacement of the lungs, the presence of abdominal organs and gas in the chest cavity (Burns et al., 2013; Hyun, 2004; Nikiphorou et al., 2016; Ozer et al., 2007).

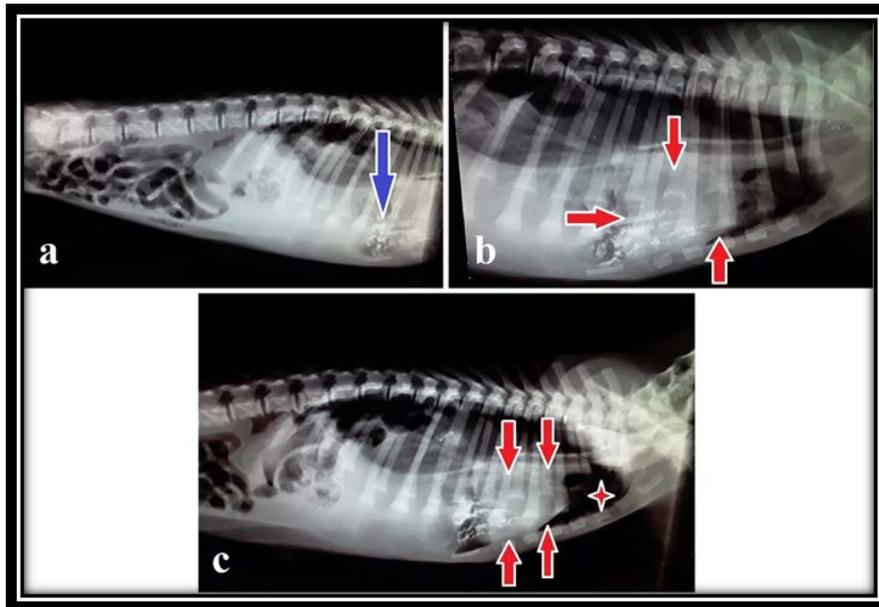
The only treatment for diaphragmatic hernias is surgery (Park & Lee, 2018; Randall, 2018; Yaygingul et al., 2019). In diaphragmatic hernia operations, first of all, the herniated organs are slowly taken back into the abdominal cavities. Then, the damage to the diaphragm is repaired with simple continuous sutures using absorbable and non-absorbable suture materials. In order to create negative air pressure in the thorax, the lungs are completely filled with air before the last suture is applied (Ozer et al., 2007).

In this case report, it was aimed to contribute to the literature and clinician veterinarians by giving information about the diagnosis, treatment and postoperative prognosis of a diaphragmatic hernia case encountered in a crossbred stray dog brought with the complaint of post-traumatic respiratory depression.

### Case Description

In this case report, a 5-month-old female and cross breed dog, who was brought to Firat University Animal Hospital Surgery Department with the complaint of respiratory distress after trauma (traffic accident), was discussed.

In the inspection examination, respiratory distress and ecchymosis of the mucous membranes were determined in the dog. It was determined that abdominal organs could not be detected in the abdominal cavity on palpation, and heart and lung sounds decreased on auscultation of the thorax. In addition, bowel sounds were detected on auscultation of the thorax. After clinical examinations, it was suspected that the dog had a diaphragmatic hernia. For the definitive diagnosis, thorax and abdomen radiographs of the dog were requested. In the radiographs taken in the LL position, it was determined that the diaphragm line could not be seen (Figure 1-a, b, c), the heart was seen in silhouette (Figure 1-b,c), and the abdominal organs were located in the thorax (Figure1-a). However, the presence of free air in the thorax was detected in the radiographic examination (Figure 1-c). Thus, the patient was definitively diagnosed with diaphragmatic hernia.



**Figure 1.** Direct radiography of the thorax and abdomen in the LL position: the diaphragm line cannot be seen (a,b,c), the view of the digestive system contents inside the thorax (blue arrow) (a), the silhouette view of the heart (red arrow) (b,c), free air in the thorax (star) (c).

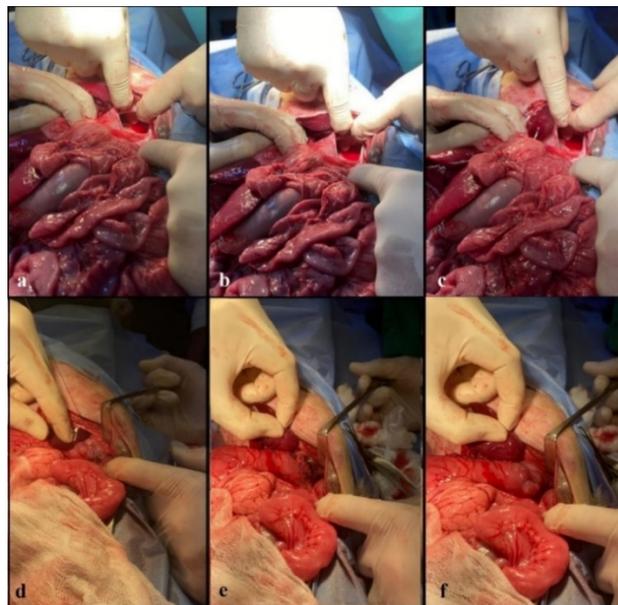
It was decided to take the dog, which was diagnosed with diaphragmatic hernia, to urgent operation. First of all, the large area from the half of the sternum to the pubis was prepared for the operation. After the preparations were completed, induction was achieved by

intravenous administration of propofol at a dose of 4 mg/kg to the dog with diaphragmatic hernia. Afterwards, the patient was placed under inhalation anesthesia with isoflurane by placing an endotracheal tube (6 mm diameter, cuffed).

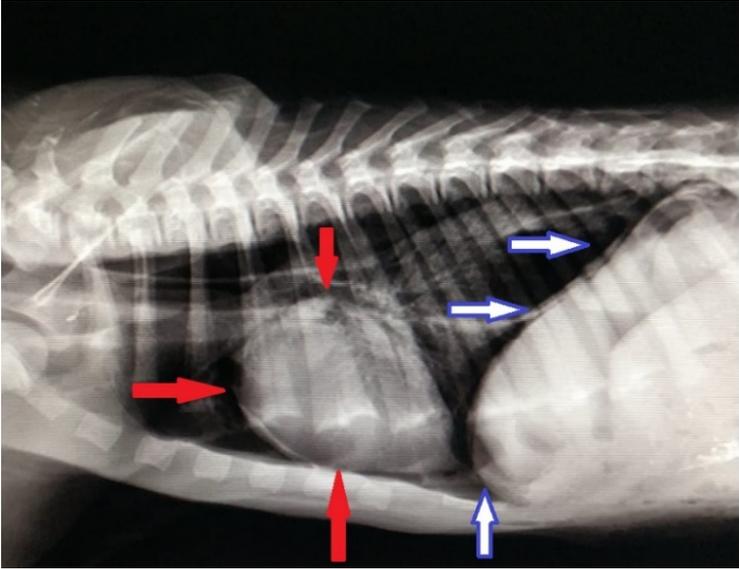
A median incision was made in the anesthetized dog, and the abdominal cavity was entered. In the examination of the abdominal organs by inspection and palpation, it was determined that the stomach, spleen, duodenum and jejunum were herniated through the opening on the left side of the diaphragm. After the reduction of the herniated organs into the abdomen with slow movements, the diaphragm was started to be repaired by suturing with reverdin sutures (Vicryl, USP:2-0) (Figure 2).

To reduce the risk of pulmonary edema, the lungs were fully inflated before the final suture was applied to the diaphragm. In the postoperative radiograph, it was determined that the diaphragm line and the heart were clearly seen (Figure 3).

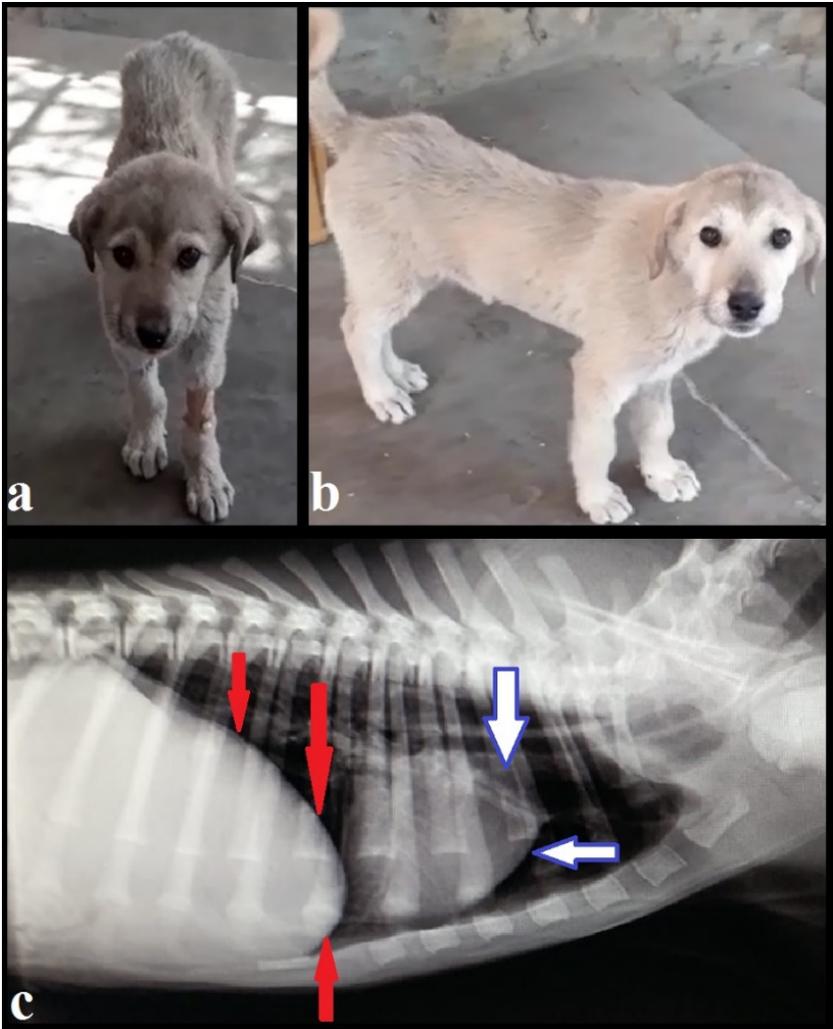
In the postoperative period, oxygen support was provided to the patient for 24 hours. In addition, amoxicillin-clavunic acid (Synulox, Zoetis, Italy) at a dose of 8.75 mg/kg was administered intramuscularly for 7 days. In the postoperative period, meloxicam (Bavet meloksikam, Bavet, Istanbul) was administered subcutaneously at a dose of 0.2 mg/kg for pain management. In the clinical and radiological examinations performed on the 15th, 30th and 60th days after the operation, it was determined that the general condition of the patient was good and there was no respiratory problem (Figure 4).



**Figure 2.** Abnormal opening formed by the left side of the diaphragm, diaphragmatic hernia (a, b, c), closure of the opening in the diaphragm, herniorrhaphy (d, e, f).



**Figure 3.** Postoperative radiographic findings; image of the heart (red arrows) and the diaphragm line (blue-white arrows).



**Figure 4.** Postoperative 15th day (a) and 30th day (b) image of the patient, postoperative 15th day thorax radiograph of the patient (c), diaphragm line (red arrows), heart (blue-white arrows).

## Discussion

Diaphragmatic hernia is a health problem with a high mortality rate in cats and dogs caused by congenital (5-10%) and traumatic (85%) causes. The cause of 10-15% of diaphragmatic hernias is unknown (Radlinsky & Fossum, 2013; Park & Lee, 2018; Zamirbekova et al. 2020). It is thought that the diaphragmatic hernia formed in the stray dog, which is the subject of this case report, was formed due to the trauma that occurred as a result of the traffic accident three days ago.

Liver, stomach, omentum and pancreas are among the organs that are most displaced towards the thoracic cavity in cases of diaphragmatic hernia. Hernias on the left side of the diaphragm mostly herniate the stomach, spleen and small intestines, while hernias on the right side of the diaphragm herniate the liver, small intestines and pancreas (Hyun, 2004; Zamirbekova et al., 2020). In the study of Zamirbekova et al. (2020), it was reported that liver (81%), stomach (43%), small intestine (35%), omentum (13%) and pancreas (13%) were the most herniated organs in diaphragmatic hernia cases in cats and dogs. Hyun (2004), on the other hand, reported that the liver (65%), stomach (95%), and small intestine (50%) were the most herniated organs in hernias on the left side of the diaphragm. In this case report, it was determined that the stomach, spleen, duodenum, and jejunum of the dog, which had a hernia on the left side of the diaphragm, were displaced into the thorax.

The most common clinical findings in diaphragmatic hernia cases are dyspnea and exercise intolerance due to respiratory depression. The muffled heart and lung sounds during auscultation of the thorax are among the most important clinical examination indicators (Burns et al., 2013; Nikiphorou et al., 2016; Park & Lee, 2018; Zamirbekova et al., 2020). In the study of Park & Lee (2018), reported moderate dyspnea and lethargy complaints in a two-month-old cat with diaphragmatic hernia. In the same study, they reported that during auscultation of the thorax, heart sounds were heard clearly from the right side and muffled from the left side. In this case report, dyspnea and ecchymoses on the mucous membranes were detected in the clinical examination of the dog. In addition, it was determined that lung and heart sounds could not be heard clearly and bowel sounds were heard during auscultation of the thorax. In diaphragmatic hernias, digestive system symptoms such as diarrhea, constipation, vomiting, loss of appetite can also be seen, depending on the herniated organs and their condition (Burns et al., 2013; Nikiphorou et al., 2016). In this case report, it was determined that the dog with diaphragmatic hernia did not have any digestive system symptoms.

Radiographic examinations are very important for the definitive diagnosis of diaphragmatic hernias. The most prominent radiographic findings are the absence of the

diaphragm line, the silhouetted appearance of the heart, the displacement of the lungs, the presence of abdominal organs and gas in the chest cavity (Burns et al., 2013; Hyun, 2004; Nikiphorou et al., 2016; Ozer et al., 2007). In the study of Hyun (2004), reported that in cats and dogs with diaphragmatic hernia, the heart was displaced in 70%, there was a gas mass originating from the stomach and intestines in the thorax in 73%, and the abdominal organs were displaced cranially in 97%. In this study, in the radiographic examination of the dog, the absence of the diaphragm line, the silhouetted image of the heart, the presence of intestinal contents and free air in the thorax facilitated the diagnosis of diaphragmatic hernia. In addition, in this case report, it was found that the apex part of the heart of the dog diagnosed with diaphragmatic hernia was displaced cranially.

The only treatment for diaphragmatic hernias is surgery. Pre-anesthetics that will not cause respiratory depression due to possible dyspnea should be used (Park & Lee, 2018; Randall, 2018; Yaygingul et al., 2019). Park & Lee (2018), reported that they achieved induction by intravenous administration of 8 mg/kg of propofol before the operation of a two-month-old cat with diaphragmatic hernia. In this case report, 4 mg/kg of propofol was administered intravenously to the dog for induction before the operation. Similar to the other study after induction, isoflurane anesthesia was administered via intermittent positive pressure ventilation.

In diaphragmatic hernia operations, in cases of collapsed lungs and/or pneumothorax, a chest tube can be placed in the lateral chest wall to evacuate free air (Tobias, 2017). In the case report, it was decided that there was no need for chest tube placement, since collapse did not occur in the lungs. However, in order to evacuate the small amount of free air accumulated in the chest cavity, the lungs were expected to be fully inflated before the last suture was placed on the diaphragm.

In diaphragmatic hernias, hypoventilation, shock, multi-organ failure and heart arrhythmias can cause death in the preoperative period (Boudrieau & Muir, 1987). In the intraoperative period, during the induction phase, delayed intubation and failure to control ventilation can result in death (Bednarski, 1986). In the postoperative period, the first 24 hours is the most critical period (Radlinsky & Fossum, 2013). The prognosis after the operation in diaphragmatic hernias is quite good. The survival rate in dogs is 81-87.5%, while the survival rate in cats is 86-97% (Burns et al., 2013; Nikiphorou et al., 2016). In this case report, it was determined that the prognosis of the dog that was operated for diaphragmatic hernia was good.

## Conclusion

As a result, it was concluded that diaphragmatic hernia is a health problem that causes important clinical symptoms in cats and dogs and has a high mortality rate if not treated. Contrary to this situation, it is very important to have a very high postoperative survival rate. In this study, it was aimed to contribute to the literature and our colleagues by sharing the diagnosis and treatment stages of a stray dog with diaphragmatic hernia.

## Financial Support

This research received no grant from any funding agency/sector.

## Ethical Statement

This study does not present any ethical concerns.

## Conflict of Interest

The authors declared that there is no conflict of interest.

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