Research, Society and Development, v. 12, n. 14, e20121444487, 2023
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v12i14.44487

Chronic diaphragmatic hernia and axial skeletal anomalies in a cat – Case report

Hérnia diafragmática crônica e anomalias esqueléticas axiais em um gato – Relato de caso

Hernia diafragmática crónica y anomalías esqueléticas axiales en un gato – Reporte de caso

Received: 12/04/2023 | Revised: 12/10/2023 | Accepted: 12/11/2023 | Published: 12/13/2023

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Abstract
Diaphragmatic hernia and congenital anomalies of the axial skeleton are alterations frequently identified in domestic cats. The objective of this case report was to present the electrocardiographic, radiographic, and tomographic findings observed in a 5-year-old neutered domestic shorthair cat, with skeletal malformations simultaneously with chronic diaphragmatic hernia. The cat lived well until he was 10-years old, when he developed progressive respiratory compromise leading to death. To our knowledge, occurrence of combined diaphragmatic hernia and congenital skeletal anomalies in domestic cats is very rare.
Keywords: Diaphragmatic hernia; Skeletal malformation; Cat.

Resumo
Hérnia diafragmática e anomalias congênitas do esqueleto axial são alterações frequentemente identificadas em gatos domésticos. O objetivo deste relato de caso foi apresentar os achados eletrocardiográficos, radiográficos e tomográficos observados em um gato doméstico castrado, de 5 anos de idade, que apresentava malformações esqueleticas, em simultâneo com hérnia diafragmática crônica. O gato viveu bem até os 10 anos, quando desenvolveu grave insuficiência respiratória que o levou à morte. Até onde sabemos, a ocorrência de hérnia diafragmática em simultaneo com anomalias esqueléticas congênitas em gatos domésticos é muito rara.
Palavras-chave: Hérnia diafragmática; Anomalia esquelética; Gato.

Resumen
La hernia diafragmática y las anomalías congénitas del esqueleto axial son alteraciones frecuentemente identificadas en los gatos domésticos. El objetivo de este reporte de caso fue presentar los hallazgos electrocardiográficos, radiográficos y tomográficos observados en un gato doméstico, castrado de 5 años de edad, que presentó malformaciones esqueléticas axiales, simultáneamente con hernia diafragmática crónica. El gato vivió bien hasta los 10 años, cuando desarrolló una grave insuficiencia respiratoria que le llevó a la muerte. Hasta donde sabemos, la aparición de hernia diafragmática concomitante con anomalías esqueléticas congénitas en gatos domésticos es mucho rara.
Palabras clave: Hernia diafragmática; Malformaciones esqueléticas; Gato.

1. Introduction

Diaphragmatic hernia (DH) known also as pleuroperitoneal hernia is defined as the loss of continuity of any part of the diaphragm permitting protrusion of abdominal organs into the thoracic cavity (Mison, 2015; Blake, 2019; Hyun, 2004).

DH is an injury frequently recognized in small animal clinics and may be congenital or acquired in origin, and acute or chronic in duration. The majority (85%) of cases are acquired and secondary to blunt trauma, while 5%~10% are congenital, and the rest no causes are known (Ozer et al., 2007; Park and Lee, 2018; Blake, 2018). When organs such as the intestines, stomach, spleen and liver herniate into the thoracic cavity causes compression of chest contents, causing compromised lung function (Blake CA, 2018). In fact, respiratory disturbance is common in DH, but extra-respiratory signs such as vomiting, dysphagia, diarrhea, lethargy, and constipation may occur, especially when gastrointestinal viscera is displaced into the thoracic cavity (Ozer et al. 2007; Minihan et al., 2007).

The most common site of herniation is in the right side of the diaphragm (Merhjerdi et al, 2022), and, in order of the frequency, liver, stomach, omentum, and pancreas are the organs most displaced towards the thoracic cavity. When the herniation is in the left side, is more frequent the stomach, spleen and small intestines pass into the chest cavity (Hyun, 2004).

Regarding congenital skeletal anomalies, they are common among dogs and cats, with variable clinical significance, and frequently constitute incidental finding during radiograph examination (Westworth, 2010). Different anomalies of feline vertebral column have been described: thoracization of C7, blocked vertebrae, thoracic lumbarization of T13 (and absent ribs), 12 thoracic vertebrae, 14 thoracic vertebrae, extra-lumbar vertebrae, thoracization of L1, and lumbar sacralization (Newitt et al., 2008; Tremolada et al, 2012). However, the concomitance of chronic diaphragmatic hernia with skeletal anomalies is a condition rarely reported in the veterinary literature (Moura et al., 2010).

The objective of this case report was to present the electrocardiographic, radiographic, and tomographic findings observed in a 5-year-old neutered domestic shorthair cat, with skeletal malformations simultaneously with chronic diaphragmatic hernia.

2. Methodology

In this case report, qualitative methodology was used a detailed description of clinical and complementary methods for diagnosing chronic diaphragmatic hernia and skeletal malformations in a domestic feline patient.

A five-year-old mixed male cat was referred to cardiology evaluation because of eventual vomiting and tachypnea. There was no story of trauma. The feline presented good body condition score and cardiac auscultation revealed no abnormalities. Abdominal ultrasonography was not diagnostic for diaphragmatic hernia.

A six-lead electrocardiogram was performed with the patient manually restrained on right lateral recumbence, according to methodology of Tilley, 1985.

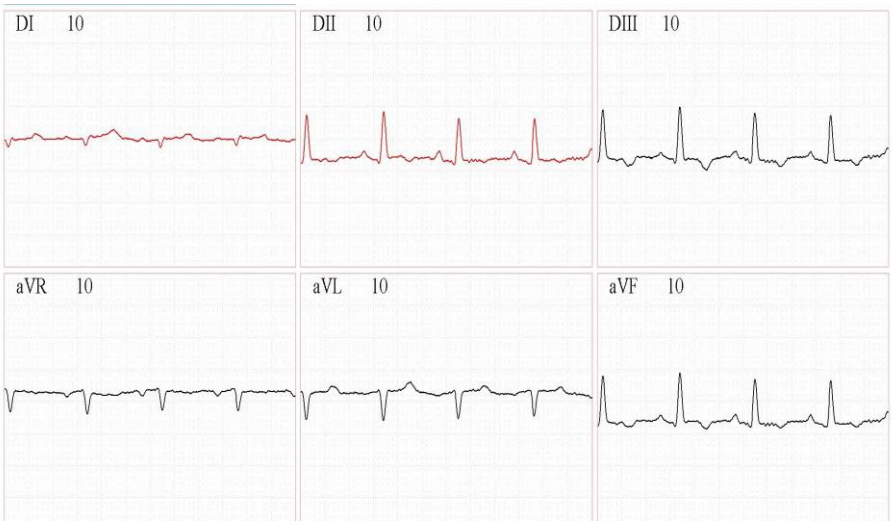
For radiographs of thorax and abdomen was used both ventro-dorsal and right lateral projections, without sedation or anesthesia.

For computed tomography, the cat received general anesthesia, placed in sternal and right lateral recumbences, and the images acquired in the transverse and medial sagittal planes, from the first cervical vertebra to the sacrum, with pre-and post-contrast image acquisition, taking slices thickness of 3 mm.

3. Results

The six-lead computed electrocardiogram (Figure 1) showed values within the normal reference ranges for the species (Tilley, 1985; Willis 2018).

Figure 1 - Six-lead digital electrocardiogram.

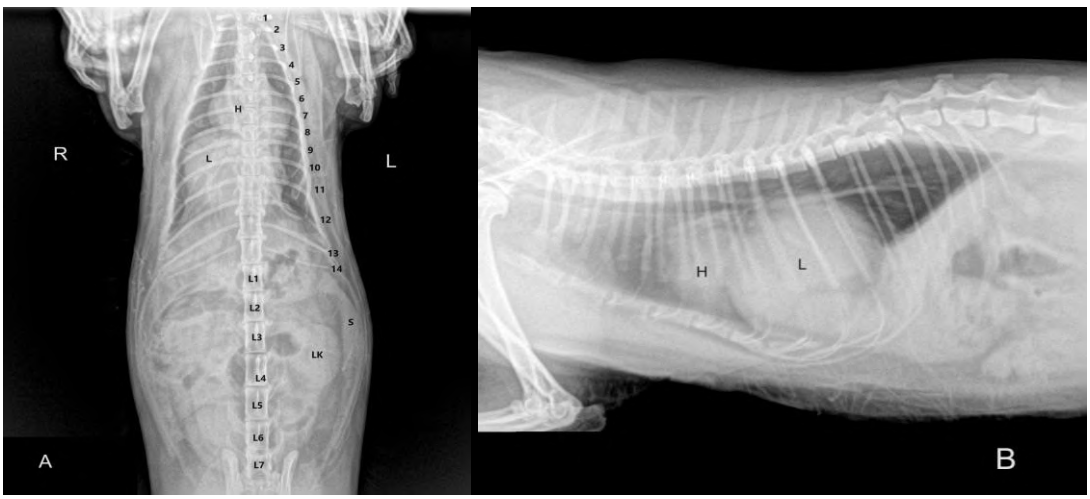


Source: Authors (2023).

Six-lead ECG showing normal PQRS-T pattern. Sinus rhythm, heart rate= 188 bpm; SÂQRS= + 110 degrees (frontal plane).

Ventro-dorsal radiography (Figure 1A) showing a “mass” of soft tissue opacity in right caudo-ventral portion of the thorax, identified to as liver (L). The cardiac silhouette (H) is pushed cranially. There are fourteen vertebrae (1-14), with correspondent 14 pairs of ribs. Except the liver itself, no other abdominal organs seemed to be inside the thoracic cavity. L1-L7= lumbar vertebrae. Left kidney: LK. Right lateral radiograph (Figure 2B), shows partial loss of the ventral border the diaphragmatic line, sugestive of diaphragmatic hernia. Tracheal dorsalization is noted.

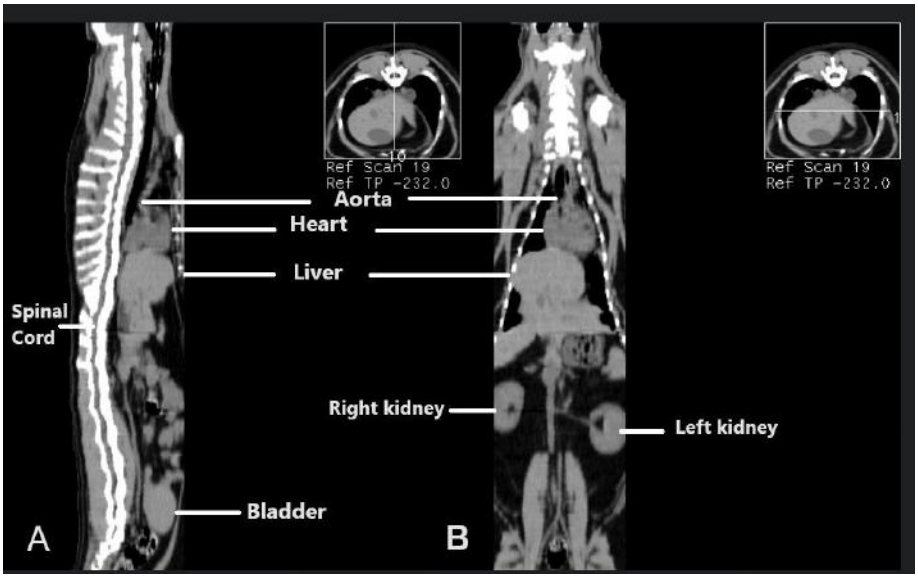
Figure 2 - Thoracic and abdominal radiography.



Source: Authors (2023).

Tomography images, sagittal medial (Figure 3A) and dorsal (Figure 3B) planes, demonstrating the liver in the thoracic cavity. The heart is cranially pushed. The spinal cord seems to be intact.

Figure 3 - Tomography images, post-contrast phase, after multiplanar reconstruction.



Source: Radiovet and Centro Veterinário Colina (2023).

4. Discussion

Diaphragmatic hernia in cats is a injury that causes high concern due the elevated risk of mortality, specially when occurs complications such as pneumothorax, lobe torsion, necrosis of the liver or lung, and strangulation of the intestines during the chronicization process (Deveci et al., 2022).

However, in chronic DH the clinical signs may be minimal and undetected for years when the degree of pulmonary compromise is minor, although an asymptomatic animal may eventually present with respiratory and/or gastrointestinal signs (Pereira et al., 2023) as observed in our patient.

Most cases of acute diaphragmatic hernia in cats in order of frequency are secondary to blunt trauma, usually motor-vehicle accident, falls, dog bites, maltreatment but, in almost 1/4 of cases the cause could not be assigned (De Bastiani et al., 2023; Pereira et al., 2020, Deveci et al, 2022). The patient of this case report had no known history of trauma, which is common in feline DH. It was not possible to clarify if this cat had an acquired or congenital a DH, because necropsy was not performed.

Plain radiography constitutes the single most useful diagnostic method for acute or chronic DHs, being capable to ensure correct identification in the majority of cases, although an herniated organ can be confused with a true pulmonary mass ((Moyer et al, 2020; White et al. 2002). In this case, ultrasound examination can be useful to detect hepatic tissue in the thoracic cavity and may show a diaphragm defect (Williams et al., 1998). However, in our patient, the results of ultrasonography were not sufficient to ensure diagnosis of DH. Therefore, the combination of both plain radiography and computed tomography demonstrate with sufficient clarity not only the diaphragmatic defect but also skeletal anomalies not suspected before.

5. Conclusion

As seen in this case report, identification of chronic DH in cats may constitutes a diagnostic challenge, since the symptoms are variable and non-specific, while the history of trauma is frequently unknown. Thus, the combination of different types of imaging techniques constitutes a good way to identify diaphragmatic hernias and eventual concomitant body abnormalities.

In view of these results, we recommend that in cases of suspected diaphragmatic hernia, different imaging diagnostic modalities be performed to confirm the diagnosis.

References

Blake C. A. (2018). Diaphragmatic Hernia. In: Textbook of Small Animal Emergency Medicine, vol-1. Edited by Kenneth J. Drobatz. John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA

Bastiani D. et al. (2023). Complications and outcome of traumatic diaphragmatic hernia repair without post-operative chest drain: Retrospective study in 90 cats. *Open Veterinary Journal*, 13(6), 677–683. 10.5455/OVJ.2023.v13.i6.1.

Deveci M. Z. Y. et al. (2022). Herniorrhaphy and Surgical Outcomes of Diaphragmatic Hernias in cats. *Slovenian Veterinary Research*, 59(1), 47–57. https//doi:10.26873/SVR-1295.

Hyun C. (2004). Radiographic diagnosis of diaphragmatic hernia: review of 60 cases in dogs and cats. *Journal of Veterinary Science*. 5(2): 157–162.

Mehrjerdi H. K. et al. (2022). A retrospective study on diaphragmatic hernia in cats. *Veterinary Research Forum*. 13(4), 607-610. https//0.30466/vrf.2022.138996.3092. Epub 2022 Dec 15. PMID: 36686864.

Liste F., et al. (2011). What is your diagnosis? *Journal of the American Veterinary Medical Association*, 238(5), 569-570.

Minihan A. C., Berg J. & Evans K. L. (2004). Chronic diaphragmatic hernia in 34 dogs and 16 cats. *Journal of American Animal Hospital Association*, 40(1):51-63. 10.5326/0400051.

Mison M. B. (2015). Diaphragmatic Hernia. In: Coté E., Clinical Veterinary Advisor. Dogs and Cats. Third Edition. Elsevier Moby. St. Louis.

Moura E., et al. (2010). VACTERL association in a cat. *American Journal of Medical Genetics.* Part A 152A:777–780.

Moyer, A. L. et al. (2020). Diaphragmatic hernia presenting as a pulmonary mass in a dog. *Veterinary Record Case Reports*. Eight (3), e001170. 10.1136/vetreccr-2020-001170.

Newitt A., et al. (2008). Congenital abnormalities of the feline vertebral column. *Veterinary Radiology & Ultrasound*, 49, (1), 35–41.

Ozer K., et al. (2007). Diaphragmatic hernia in cats: 44 cases. *Medycyna Wet*. 63, 1564-1567.

Park S. & Lee J. (2018). Diaphragmatic Hernia in Two-month-Old Cat. *Journal of Veterinary Clinic* 35(5), 237-239 http://dx.doi.org/10.17555/jvc.2018.10.35.5.237.

Pereira G.J. et al. (2023). Eleven-year retrospective analysis of acquired diaphragmatic hernia in 49 dogs and 48 cats. *Canadian Veterinary Journal* 64, 149–152.

Tilley L.P. (1985). Analysis of PQRS deflections. Essentials of canine and feline electrocardiography. Second ed., Lea and Fibiger, Philadelphia, USA, 57–97.

Tremolada G. et al. (2013). Persistent right aortic arch and associated axial skeletal malformations in cats. *Journal of Feline Medicine and Surgery* 15(2) 68–73. 10.1177/1098612X12459736.

Westworth D.R. et al. (2010). Veterinary Clinic - Small Animals. 40: 951–981. 10.1016/j.cvsm.2010.05.009.

Williams J., Leveille, R., & Myer, C. W. (1998). Imaging modalities used to confirm diaphragmatic hernia in small animals. FAO: 1199-1210.

Willis R. (2018). Electrocardiography. In: Guide to Canine and Feline Electrocardiography Willis R., Oliveira P. and Mavropoulou A. (Eds.). Wiley & Sons Ltd. Oxford, UK.

White J. D. et al., (2003). Diaphragmatic hernia in a cat mimicking a pulmonary mass. *Journal of Feline Medicine and Surgery*, (5), 197–201. https//doi:10.1016/S1098-612X (02)00069-4.