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Case Report

Diaphragmatic Hernia and Its Surgical Management in A Cat

Udharwar Sanjaykumar Vithalrao, Sudheesh S. Nair, Soumya Ramankutty and K. D. John Martin

College of Veterinary and Animal Sciences, Mannuthy, Thrissur, KAVASU, Wayanad, Kerala, INDIA

*Corresponding Author: sanjay.udharwar@icar.gov.in

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Abstract

An eight-month-old male non-descript cat was presented to the University Veterinary Hospital, Mannuthy, Kerala Veterinary and Animal Sciences University with symptoms of dyspnea, vomiting, and reduced appetite. A radiographic examination was performed and the condition was diagnosed as a diaphragmatic hernia. Surgical correction was done. The herniated contents were found to be liver, stomach, and intestinal loops. The animal had an uneventful recovery.

Keywords: Cat, Diaphragmatic hernia, Herniorrhaphy

Introduction

A diaphragmatic hernia (DH) is a condition in which a defect of diaphragm permits one or more organs from abdominal cavity to protrude into thoracic cavity. It affects both cats and dogs and can be either congenital or acquired (Gibson *et al.*,2005). Approximately 85% of feline diaphragmatic hernias are caused by trauma (Fossum, 2002; Hunt *et al.*, 2003). Kicks, falls, and fights are regularly reported, while automobile accidents are the main cause of trauma (Walker *et al.*,1965, Wilson *et al*., 1971; Wilson *et al*. 1986; Boudreau *et al*.1987). The diaphragm can be injured directly or indirectly, but indirect injuries caused by blunt force are more common. The peritoneal-ural gradient increases when force is applied to the abdominal cavity with the glottis open, and visceral herniation can happen right away after the diaphragm ruptures (Dronen, 1983).

According to the study, animals with diaphragmatic hernias experienced perioperative death rates of between 8 and 18 percent (Schmiedt *et al*., 2003). Surgical hernia reduction is necessary to restore normal physiological respiratory function with normal diaphragm reconstruction (Helphery, 1982).

A case of traumatic diaphragmatic hernia in an eight-month-old non-descript domestic cat and its successful surgical correction is placed on record.

Materials And Methods

An eight-month-old male non-descript tom cat weighing 1.83 kg was presented to Teaching Veterinary Clinical Complex (TVCC), Mannuthy with a complaint of decreased appetite, vomiting, mild dyspnea, abdominal respiration, and lethargy.

On auscultation of the thorax, pleural friction rub sounds were audible. On palpation of the abdomen, fluid-filled intestinal loops and a distended bladder were evident.

A confirmatory diagnosis was done by radiographic examination. The radiographic images revealed the disappearance of the diaphragmatic contour and the shadow of intestinal loops with tubular air fills. Granulopenia (2.5×10^3/µl, reference range: 3.6-12.7 x 10^3/µl), monocytosis, hypochromia, anisocytosis, and lymphocytosis (9×10^3/µl, reference range: 1.1-10.7 x 10^3/µl) were all detected in the complete blood count. This outcome appeared to be the result of an inflammatory response in the herniated lesion.

Induction of anesthesia was performed with a combination of ketamine (25mg/kg body weight) and midazolam (0.5 mg/ kg body weight) given intramuscularly. After the loss of jaw tone, immediate intubation was done with an endotracheal tube of size 3.5mm. The patient was maintained with sevoflurane in oxygen via intermittent positive pressure ventilation (IPPV).

The patient was positioned in dorsal recumbency. The caudal thoracic and abdomen was prepared for an aseptic procedure. All the vital parameters were maintained. A midline incision was initially made from the xiphoid to the umbilicus. The falciform ligament was excised to improve the exposure of the hernia. A portion of the liver, stomach, and a significant portion of the small intestine, that herniated were carefully retrieved from the thoracic cavity. The diaphragmatic defect of 2-3 cm, located at 2 O' to 3 O'clock position was repaired using 3-0 polyglactin-910 (Advacryl, Advanced MedTech Solutions Private Limited, Vadodara) in a simple continuous suture pattern. Negative pressure within the thoracic cavity was reestablished using a manual suction using a cannula and simultaneous expansion of the lungs by manual ventilation along with the last herniorrhaphy suture. The abdominal contents were reduced. The *linea alba* and the subcutaneous tissue of the abdomen were closed in a routine manner using 3-0 polyglactin-910. The skin wound was closed using 3-0 nylon in a simple interrupted suturing pattern.

Postoperatively, a radiograph was taken to confirm the correction. Post-surgery, an injection of ceftriaxone @ 20mg/kg body weight IM and an injection of meloxicam @0.2 mg/kg body weight IM was administered twice daily for five consecutive days along with meloxicam as an analgesic. The surgical wound was dressed routinely using povidone-iodine. Only semisolid food was advised to feed for the first 5 days. Strict cage rest was advised to restrain the animal. The patient was examined on the seventh postoperative day and was found to be healthy and fine with normal physiological parameters. On the 10^{th} post-operative day, the sutures were removed and the animal had an uneventful recovery.

Discussion

Cats typically develop acquired diaphragmatic hernia as a result of a congenital condition or traumatic injury. Congenital hernias in animals can cause them to pass away soon after birth or right away (Fossum, 2013). A congenital hernia is mostly dorsolateral in position (Fieldman *et al*., 1968; Valentine *et al*., 1988). However, the most common type of traumatic diaphragmatic hernia in cats are circumferential tears (59%) and radial tears (18%) (Garson *et al*. 1980). In the present case, a circumferential tear at the 2 O' to 3 O'clock position was noticed. Although no signs of trauma were evident during the physical examination, radiological examination, or direct observation during surgery, the nature of the tear lead to a conclusion of traumatic diaphragmatic hernia.

Typical radiographic indications include loss of the diaphragmatic line and cardiac profile, abdominal organ appearance, intestinal loops, gas in the thorax, or a thin abdomen (Hyun, 2004). There have been reports of almost all abdominal structures protruding into the thoracic cavity, however, the liver, stomach, small intestines, spleen, omentum, and pancreas are frequently herniated organs (Gibson *et al*., 2005). Chest radiography alone may not be able to determine the problem if there is pleural effusion, less abdominal organ herniation, or no air shadow in the herniated organs. Consequently, an ultrasonogram or contrast examination offers a certain diagnosis (Stickle, 1984; Williams *et al*., 1998; Fossum, 2013). In the present case, the diaphragmatic hernia could be diagnosed by confirming the presence of gas-filled bowel entering the thoracic cavity, loss of cardiac silhouette, and loss of contour of the diaphragm (Fig. 1 and Fig. 2).

Fig. 1: X-ray image of lateral thorax view before surgical correction of DH.

Fig. 2: X-ray image of ventrodorsal thorax view before surgical correction of DH.

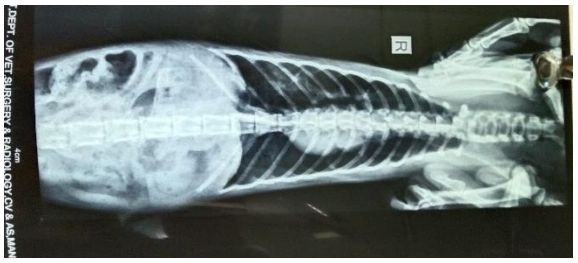

Fig. 3: X-ray image of ventrodorsal thorax view after surgical correction of DH.

Before inducing anesthesia in animals with weakened respiratory systems, all respiratory depressants such as xylazine, medetomidine, dexmedetomidine, and others must be avoided. Ketamine (22-33 mg/kg body weight IM) can be administered for induction if the patient's heart function is normal. But muscle rigidity, the possibility of seizures, and tachyarrhythmias are made worse by ketamine alone. By including benzodiazepines in the anesthetic protocol (midazolam at the dose rate of 0.5-1 mg/kg body weight IM), these effects are lessened. Sevoflurane or isoflurane are appropriate options for maintaining anesthesia (Fossum, 2013). In this operation case, ketamine (25

mg/kg body weight) and diazepam (0.5 mg/kg body weight) were mixed in one syringe and administered intramuscularly to produce anesthesia. Isoflurane was used for the maintenance which gave satisfactory anesthesia till recovery.

About 15% of animals pass away before receiving anesthesia and have traumatic diaphragmatic hernias surgically corrected. The causes of perioperative mortality include hypoventilation, abdominal visceral compression of the lungs, shock, multiorgan failure, and cardiac arrhythmia. (Wilson, 1971; Garson, *et al*., 1980; Boudrieau and Muir, 1987)

An 82 percent to 89 percent post-operative survival rate was observed in recent studies with a feline diaphragmatic hernia (Schmiedt *et al*., 2003; Minihan,2004; Gibson *et al*., 2005). In particular, if the hernia is persistent and adhesions are present, pneumothorax is the most frequent consequence following surgical treatment of a diaphragmatic hernia. Patients with chronically compressed lungs may develop re-expansion pulmonary edema (Trachiotis *et al*., 1997). Diaphragmatic hernia in animals causes dyspnea as well as pleural effusion, hemothorax, gastric torsion, shock, hemorrhage, and arrhythmia (Wilson 1971; Bellah, 1998). The procedure for doing a diaphragmatic herniorrhaphy in this instance went off without any problem.

Conclusion

A domestic tom cat that was eight months old had a diaphragmatic hernia and displayed certain symptoms like mild dyspnoea, a decreased appetite, lethargy, and rubbing sounds on chest auscultation. Additionally, radiographic images revealed the disappearance of the diaphragmatic line and the shadow of intestinal loops with tubular air fills. Ketamine at the rate of 25 mg/kg and midazolam at the rate of 0.5 mg/kg body weight was administered intramuscularly to induce anesthesia during the procedure. Isoflurane was used to maintain anesthesia. The larger diaphragm defect allowed access to the liver, stomach, and small intestine in the thoracic cavity. Herniorrhaphy was done following laparotomy and these viscera were moved to the abdomen (Fig. 3) and the cat had an uneventful recovery. If the right surgical procedures are carried out before serious clinical problems manifest, a positive prognosis can be anticipated in cats with diaphragmatic hernias. In cats undergoing diaphragmatic herniorrhaphy, a combination of intramuscular injections of ketamine and midazolam and isoflurane inhalation may be used to induce anesthesia in addition to isoflurane inhalational anesthesia maintenance.

Contribution by Authors

All the authors contributed equally to writing the manuscript. The final manuscript was read by all others and consented to publication.

- Udharwar Sanjaykumar V. Writing original draft, investigation, and supervision.
- Sudheesh S. Nair: Conceptualization, methodology, and editing.
- Soumya Ramankutty: Visualisation, investigation, and supervision.
- Dr. John Martin K. D.: Drafting and editing.

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Conflict of Interests

There is no conflict of interest.

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