

The surgical management of a diaphragmatic hernia in a cat – case report

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Abstract

A diaphragmatic hernia is an internal hernia, characterized by a defect of the musculotendinous plate between the thoracic and abdominal cavities, which allows the abdominal content to protrude into the thoracic cavity. This case study emphasizes the importance of choosing the propitious time in the surgical repair and also the anaesthesia principles in diaphragmatic herniorrhaphy. A 2-year-old intact female cat was referred with the following symptoms: open-mouth breathing, tachypnea, tachycardia, pale mucous membranes and a dyspnoea increasing when changing position. The definitive diagnosis was confirmed through thoracic and abdominal radiography and the surgical procedure was performed after the patient's condition was stable.

Key words: diaphragmatic hernia, surgical repair, anaesthesia

Introduction

A diaphragmatic hernia, congenital or acquired, develops when the continuity of the diaphragm is disrupted and the abdominal contents protrude into the thoracic cavity (Fossum, T. W. et al., 2013). Congenital or pleuroperitoneal hernia are seldom seen in dogs and cats because the affected animals usually die at birth or shortly thereafter (Tobias, K.M., 2017; Monnet, E., 2013). The most common diaphragmatic ruptures are those resulting from severe changes in abdominal and thoracic pressures, usually after blunt trauma, particularly motor vehicle accidents (Fossum, T. W. et al., 2013). The defect leads to a life-threatening respiratory condition and a potential entrapment of abdominal organs (Gibson, T. W. et al., 2005).

The most common clinical signs are dyspnea and vomiting, but the physical examination findings may vary according to hernia origin (chronic or recent), animal age, concurrent disorders, type of viscera involved or the size and location of the diaphragmatic defect, such that nonspecific signs such as lethargy, anorexia and weight loss are seen. (Besalti, O. et al., 2011; Fossum, T. W. et al., 2013; Monnet, E., 2013; OZER, KURSAT, et al., 2007)

The treatment of choice is the surgical repair, but there is some controversy over timing of surgical intervention. One study suggest that mortality rate is higher in patients which had the surgery performed in the first 24 hours after the accident, or more than one year (Boudrieau et al. 1987), while a more recent one reported that dogs and cats that underwent surgery within 24 hours of admission had a good perioperative survival rate (Gibson, T. W. et al., 2005). Patients with overt symptoms of congenital diaphragmatic hernia are good candidates for surgical herniorrhaphy, but those that have mild or no clinical signs can receive a conservative treatment (Tobias, K.M., 2017; Reimer, S. B. et al., 2004). Another factor influencing the outcome of the procedure is represented by the anesthetic protocol, because of the animal's already compromised ventilation. Drugs with minimal respiratory depressant effect are recommended. Before and also during induction, oxygen should be provided to improve myocardial oxygenation; during maintenance variation of pressure ventilation has to be done in order to avoid apnea or reexpansion pulmonary edema. (Tobias, K.M., 2017; Fossum, T. W. et al., 2013).

Materials and methods

The study was conducted on a 2-year-old female cat, mixed breed, unspayed, 2,5 kg with acute onset of dyspnea, elevated heart rate, open-mouth breathing and pale oral and conjunctival mucosa. The cat resided both indoors and outdoors, thus recent trauma could not be ruled out.

Although haematology, biochemistry and urinalysis were unremarkable a slight elevation in liver enzymes was observed. The radiological exam revealed an indistinct diaphragmatic line and unusual soft tissue densities within the pleural cavity. Following the presumptive diagnosis of diaphragmatic hernia the patient was prepared for surgical correction of the defect.

The patient was premedicated with methadone at a dose rate of 0,3 mg/kg intravenously and the induction was made with propofol at a dose rate of 6 mg/kg intravenously. Maintenance was performed with isoflurane (2,5%).



Figure 1. Preoperative management

The cat was placed in dorsal recumbency (Fig. 1) and the abdominal area was aseptically prepared for the surgical intervention (Fig. 2). The surgical approach includes a ventral median incision of the skin and muscular layer. Preceding this, the high-pressure ventilation which was previously induced, has to be immediately reduced in order to avoid rapid lung expansion.

Results

Once the abdominal cavity was opened (Fig. 3), the hernia site was identified and the protruded viscera were retracted smoothly into the abdomen as a result of the lack of adhesions (Fig. 4). The herniated organs were represented by the liver and the intestinal ansae. The organs were carefully examined for ischemia or other lesions and no damage was noticed.



Figure 2. Preparing the surgical area

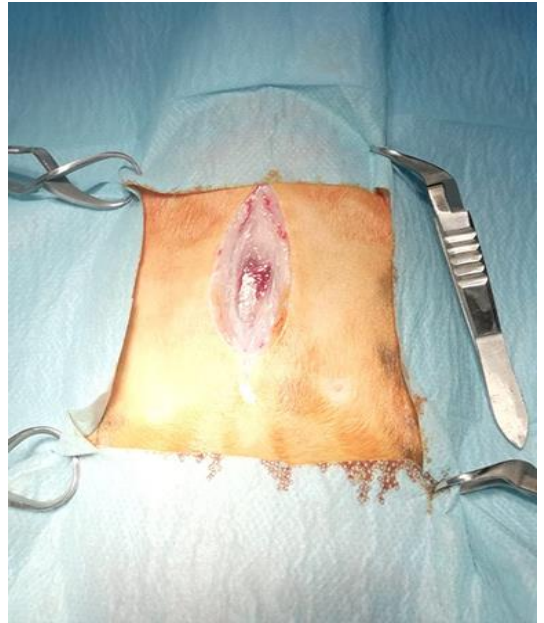


Figure 3. Skin incision

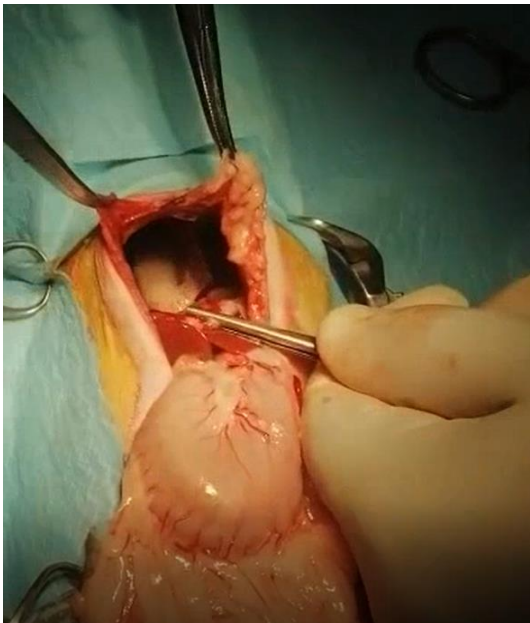


Figure 4. Hernia ring

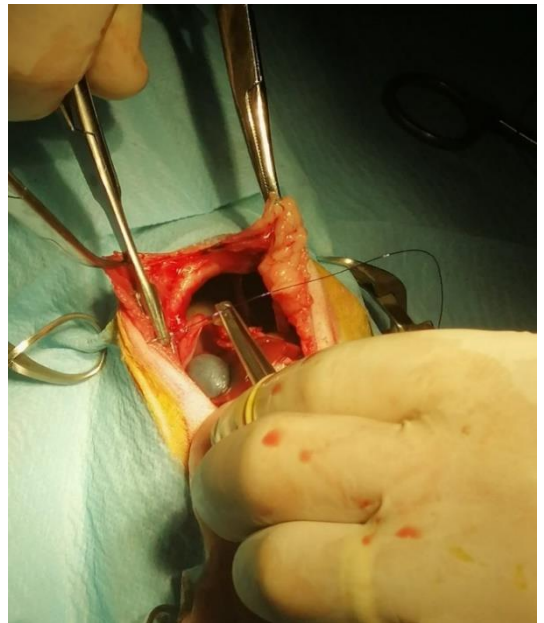


Figure 5. Hernia defect closure

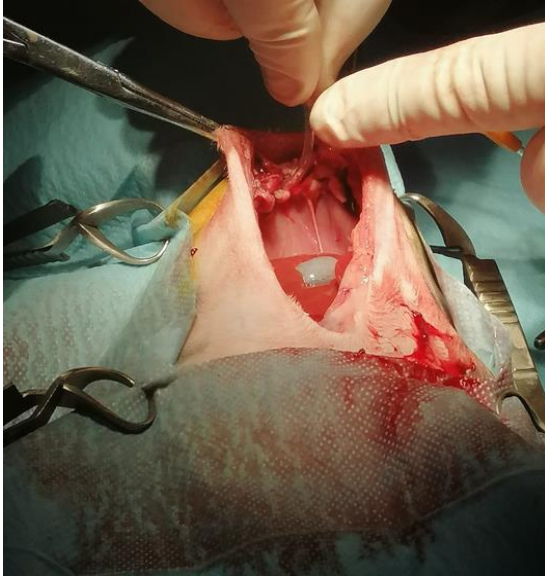


Figure 6. Pleural air removal

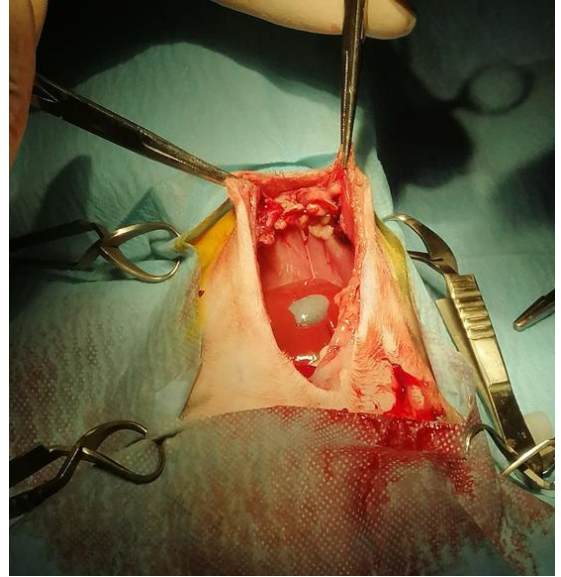


Figure 7. Inspecting the diaphragm integrity

The diaphragmatic defect is closed in a simple continuous suture pattern using an absorbable suture material (Fig. 5). Before placing the last suture, a fenestrated catheter attached to a three-way stopcock, must be used in order to remove the air from the pleural cavity (Fig. 6). The diaphragm surface and the abdominal cavity are explored for other associated injuries, but no lesions are found (Fig. 7). The abdominal incision is closed routinely in a multiple layer closure, using a continuous suture for the muscular layer and a simple interrupted one for the skin.



Figure 8. Postoperative management

Discussions

Different factors may influence whether to follow a conservative treatment or to proceed with surgical reconstruction. There are records which show that occasionally, when dealing with a very wide defect linked with a poor condition of the patient, both types of treatment might not be

successful and the animal has to be euthanized (Keep, J. M., 1950). In more recent studies, for hernia rings that cannot be completely closed, patching has been reported using omentum, muscle, polypropylene mesh and also silicon rubber sheeting (Hunt GB, et al., 2013). On the contrary, in other cases the enlargement of the hernia defect has to be performed in order to remove incarcerated viscera that can not be reduced through gentle traction. (Monnet, E., 2013)

Patients undergoing diaphragmatic herniorrhaphy should be carefully monitored because acute ventilatory compromise may occur. The patient in this case had a cooperative behaviour and easily tolerated the face mask, therefore, it was pre-oxygenated for about 3 minutes prior to the induction of anaesthesia. Because this wasn't a long-standing case, the adhesions weren't present and even though the defect was large, the patient recovered uneventfully. To avoid hypoventilation and secondary hypoxia, the patient was maintained after surgery in an intensive care unit connected to an oxygen concentrator (Fig. 8).

Postoperative mortality rate varies from 10% (Tobias, K.M., 2017), 14% (Minihan, A. C., et al, 2004), 17,6 % (Schmiedt, C. W., et al., 2003) to 48 % (Fossum, T. W. et al., 2013). The prognosis is usually excellent if the patient survives the first 24 hours postoperatively. Schmiedt, C. W., (2003) highlights in a retrospective study that this impact factor is significantly associated with concurrent injuries, while Thomas W. G. Gibson found in his retrospective study on 92 cases that timing of surgical intervention is also important, the early surgical intervention being associated with good perioperative survival rates.

Conclusions

Diaphragmatic hernias are associated with a semnificative respiratory embarrassment, especially those of traumatic origin, which worsens the already modified condition caused by the morphological changes of the herniated organs. In conclusion the success of this type of surgery is increased by following the appropriate anesthetic protocol; with an adequate surgical technique and postoperative care, the prognosis of the surgery should be excellent.

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