THE SURGICAL APPROACH IN THE DIAPHRAGMATIC HERNIAS IN CATS

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Abstract
A diaphragmatic hernia occurs when one or more organs of the abdominal cavity protrudes through a gap or opening into the thoracic cavity. The hernias can be congenital (usually before the kitten reaches the first year) or acquired, because of a trauma (occurs at any age). The standard treatment is the surgical procedure which includes the topographical arrangement of the organs in the abdominal cavity, the suture of the detached portion of the diaphragm and the establishment of the negative pressure in the thoracic cavity. Usually the first two organs to herniate are the liver and the stomach, but we had cases when all the organs of the digestive tract until the small intestine were herniated.
Keywords: *Diaphragmatic hernia, surgical procedure, trauma*

Introduction

The diaphragm is a musculo-membranous organ that separates the thoracic cavity from the abdominal cavity and functions like a barrier and helps the breath. A diaphragmatic hernia consists in the rupture or tearing of the diaphragm, allowing the organs to protrude into the thoracic cavity. Very frequent, the diaphragmatic hernias occur after a trauma, most often like a car accident. Thes animals can suffer several lesions that need medical examination and an increased atention from all the points of view.

There are two types of diaphragmatic henias that can be found in dogs and cats:

- Post-traumatic acute and chronic- caused by a traumatic event that provoked the rupture of the diaphragm
- Congenital- these animals are born with this defect (the most frequent type is the peritoneo-pericardial diaphragmatic hernia PPDH)

Materials and Methods

The casuistry taken into this study was formed by a number of 72 cats of different rases, sex and ages. The period taken into consideration was September 2000- September 2016. For those we used two surgical methods that aim to remedy the defects of integrity of the diaphragm and the topographical defects.

A diaphragmatic hernia can cause semnificative difficulties in breathing. The trauma that cause the hernia can also determine rib fractures, pulmonary lacerations and pulmonary bleeding. These lesions can take to pneumothorax or hemothorax. In the case that the abdominal organs protrude into the thoracic cavity, the capacity of the lungs to increase their volume during inspiration is reduced and the respiratory capacity is decreased.

The surgical procedure

Using the abdominal approach we performed an incision from the xifoid appendix to the navel. This incision can be easily expanded if necessary. Once the peritoneal cavity is open, the diaphragm is exposed and can be evaluated. Some of the hernias were not easy to visualise, especially those from the area of the dorsal pillars and of the aortic hiatus. These areas were carefully examinated even though other regions of the diaphragm were perforated. The

herniated organs were placed topographically and inspected for secondary lesions. Some of the complex lesions that were a great challenge for the surgical team were represented by the cases when we observed the torsion of one of the hepatic lobes, ruptured organs, intestinal invagination, intercostal hernias. In the cases when we found adhesions, these were undone using the dissection tehnique of dilaceration, in order to evoid a haemorrhage and the accidental deterioration of the vital tissues. Ocasionally, in the chronic cases, the hernial ring had to be excised because of the adhensions between it and the herniated organs. The segments of the diaphragmatic ring with hepatic adherences had to be separated from the diaphragm to evoid the bleeding, which is one of the most to fear enemy in this situations.

Using large pledgets and special instruments, the liver and the intestine were retracted one by one, laterally and caudally. From this moment, the diaphragmatic rupture was exposed so the examination of the thoracic cavity can be performed. All the thoracic fluids were aspirated. From this moment, the pulmons started slowly to recover their initial volume during inspiration.

The re-expansion of the pulmonary parenchyma produced very slow. Pulmonary edema can be a complication during re-expansion, especially for the cats with chronic diaphragmatic hernias. In the case that the hernia is older the 48 hours, the margins of the hernia had to be debridated. The rupture of the diaphragm was sutured using resorbable material, in one layer. The size of the resorbable wire varied from 4/0 to 2/0 with atraumatic needle. Also, for the reconstruction of the diaphragm architecture we used a suture in separate points. When the rupture is around the orifice of the caudal vena cava, large sutures have to be avoided to prevent the vascular constriction.

The same principle was applied for the aortic hiatus and esofagian hiatus. The chronic diaphragmatic hernia can require the utilisation of a muscular or fascial flap or of a flap from the epiploon to close the defect.

To evacuate the pleural space we used a tube that has to be placed before closing the diaphragm. After this moment, the closure of the defect can be finalised. Using a valve with three positions and a 50cc syringe the air from the thoracic cavity was evacuated until negative pressure was aquiered. The celiotomy was closed using the routine procedures. In the moment when the compete closure of the abdomene was realised the tube was again aspired. The pacients were consecutive placed in different positions while they were allowed to breath spontaneous. The pacients were monitored during the intervention and after using vital monitors and pulsoximeters.

The postoperative care included monitoring the breath of the pacient, it's temperature and the colours of the mucouses and the systemic administration of amoxicillin (10-15 mg/ kg body weight) for 5- 7 days. The small cats were held on a heating system for at least 24 hours. The use of a bandage around the thorax is not advised because it can prevent the animal from breathing well. As an analgesic we used meloxicam (0.1mg/ kg body weight) to calm the pain so the animals can breath more easy. The thoracostomy tube is checked every hour for the first 4 hours, then every 6-8 hours and is removed usually 24 hours after the surgery.

In most of the cases (78%) the cats started to fell well after the surgery and tend to be very active. It's important to encourage the repose and to avoid making effort in the postoperative period.

The prognostic for the animals that suffered a diaphragmatic henia varies according to the lesions. We estimated that approximate 15% of the animals that suffer a traumatic transdiaphragmatic hernia will die before being examinated by a doctor. A treatment against shock should be established before the surgical intervention to increase the survival rates.

Animals that had the intervention performed after more then an year from the trauma had a bad prognostic because of the adherences to the other tissues or organs.

The mortality rate of the cats with PPDH that underwent the surgery was low and the prognostic for a normal functionality was excellent, with the specification that the intervention is performed after 6 months of age.

Results

According to the size of the animals, the age and the acute or chronic nature of the hernia, we used the same surgical tehnique that we consider optimum.

The age of the animals was between 6 months and 12 years. Abdominal and thoracic radiography were taken for a radiographic diagnosis. At least two radiographs in different incidence were taken. The functional recovery of the cats was extremely fast.

In 36 of the cases we performed laparatomy on the medial line of the abdomen, and in 3 cases we had to perform a median sternotomy and laparatomy.

In 22 animals we had to perform the detachment of the adhesions between the pulmons and the diaphragm and the herniated organs to permit the reduction of the hernia and the topographical repositioning.

In the case of 14 cats we had to make the resection of segments of the pulmons, liver and intestine. All the hernias were sutured without using flaps, tissue graft or other implants. 21 of the cats developed transitory complications in the postoperative period.

The mortality rate was 14%. In 78% of cases none of the initial clinical signs were present during the postoperative controls.

In two cases of female cats we found the uterus with fetuses herniated threw the diafragm because of the pressure put on the diaphragm due to the advanced gestation. This kind of hernia is very rare in the specialized literature.

Discussion and conclusion

The diaphragmatic hernia due to trauma occurs mainly in the cats that live outdoor, or indoor and outdoor, indifferent of the age or breed. It is a certain predisposition in the overweighted animals and the entire males.

The first clinical sign is severe dyspnoea that can worsen taking the animal to exitus, before any surgical intervention. On the other side, a chronic hernia can occur spontaneaous without other known episodes. The acute traumatic cases are usually accompanied by other lesions like different wounds, fractures or nervous system lesions.

The medical intervention must be correlated with the size of the animal, the age, the presence or absence of other lesions and the pathophysiological complications of the cardiovascular system.

A precocious diagnostic can help by limiting the ischemic complications that occur to the topographically moved organs.

The result of a well-performed surgery can be compromised by the neglected surveillance of the owners or their carelessness in the convalescent period of the animal.

The postoperative evolution of the pacients was generally good in the first days, in this time the pacients have been monitorized by pulse oximetry.

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