Diaphragmatic hernia is one of the most frequently observed injuries caused by trauma in cats. Study materials were a total of 44 cats (20 male, 24 female), at different ages (2-months-old to 2-3-years-old) from various breeds. Following direct radiography, positive-contrast radiography was also taken to confirm the diagnosis. General anesthesia was induced using 5% isoflurane inhalation. Following entubation, the anesthesia was continued using 1.5-2% isoflurane inhalation by a nonrebreathing system with a pediatric circle. When the repair was about to be completed, positive pressure was increased for treating atelectasis. The mortality rate in traumatic diaphragmatic hernia cases was found to be 6.8% at the end of the study. It was concluded in this study that the success of the surgery may be increased by effective anesthetic procedures.

Diagnostically, the mortality rate in traumatic diaphragmatic hernia cases was found to be 6.8% at the end of the study. It was concluded in this study that the success of the surgery may be increased by effective anesthetic procedures.

Keywords: cat, diaphragmatic hernia

Material and methods

A total of 44 cats (20 male, 24 female), at ages from 2 months to 3 years of age in different breeds were utilized. Initially the cats brought to our clinic after a trauma or with...
a complaint of respiratory difficulty were physically examined. Following direct radiography, positive-contrast radiography was also conducted to confirm the diagnosis (fig. 1a-b, 2a-b). After the definitive diagnosis was performed, routine hemogram and biochemical analyses were conducted and the general condition of the patients that did not require urgent care was stabilized.

A hemogram was conducted in 44 cases. Erythrocyte (RBC), hemoglobin (HGB), hematocrit (HCT), leukocyte (WBC) and thrombocyte (PLT) levels of the cases were evaluated. Biochemical tests were conducted in 12 of these cases as well. Aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma-glutamyltransferase (GGT) and creatine kinase (CK) levels of the cases were evaluated.

Oxygen was given for 10 min at the preanesthetic period using a mask. Meanwhile, venous access to intravenous injection was opened without causing irritation. Following this, general anesthesia was induced using 5% isoflurane (Forane® Likid, Abbott Laboratories, Istanbul, Turkey) inhalation. After entubation, the anesthesia was maintained using 1.5-2% isoflurane inhalation by a nonrebreathing system with a pediatric circle (BOC-Boyle International, Turkey). The patients were prepared for surgery under general anesthesia (fig. 3). Abdominal regions of the patients were prepared for the surgery according to aseptic surgical principles after the positioning of the animals upwards. The abdominal cavity was excised by median laparotomy. At this stage an assisted-ventilation was initiated. The herniated organs were pulled back using a wet-gauze. The slit on the diaphragm was stitched by continuous stitches using 2/0 or 3/0 polyglactin 910 suture (Vicryl® -Ethicon, Edinburgh, UK) depending on the size of the cat. During the repair of the diaphragmatic slit, the assisted ventilation was continued at a 1 sec interval using 30% capacity of the lungs. When the repair was about to be completed, positive pressure was increased to treat atelectasis. After elimination of atelectasis, the final stitch was inserted when the lungs were at complete expiration and then the pressure was decreased. The opening of the laparotomy was closed accordingly. Isoflurane inhalation was ceased and oxygen was given until spontaneous respiration and a swallowing reflex began. Postoperative radiography was taken after extubation (fig. 4). During the postoperative stage, Carprofen (Rimadyl® Pfizer Limited, UK) was given at 4 mg/kg dose as an analgesic and antibiotherapy was applied for 5 days. The stitches were removed 7-8 days after the surgery.
Results and discussion

The mean age of the cats was 10 months and varied from 2 months to 3 years. Twenty four of the 44 cats were female while the remaining 20 were male. The frequency of occurrence of diaphragmatic hernia was the highest in cross breed cats (39 cases) followed by Persian (3 cases) and Siamese (2 cases) cats.

The cause of the hernia was mostly trauma. In 4 of the cases, there were also fractures due to trauma (2 humerus, 1 femur, 1 tibia). All of the patients were brought to our clinic with the complaint of respiratory difficulty. Definitive diagnosis was made by the radiographic examination of the thoracic cavity. Other findings were dry-cough, anorexia, decreases in lung and heart sounds by auscultation, and the thinner appearance of the abdomen of the animals compared to the normal size of the cat’s abdomen.

In the laterolateral (LL) radiographies of the thorax, there were disappearances of the diaphragmatic border, presence of consolidation (pleural effusion) in 12 cases, and intestine with gas noted in 4 cases. The definitive diagnosis was made by positive contrast celioghraphy. In celiography it was observed that iodine contrast substance passed to the thoracic cavity several minutes after intra abdominal administration. The site of the hernia was determined by ventro-dorsal (VD) radiography.

Haemogram results indicated that anemia was present in very young cats (2-6 months and in both of the genders). Following biochemical analysis, an increase was determined in the levels of the liver enzymes AST, ALT and GGT, in 5 (3 females, 2 males) of the 12 cases. In the remaining 7 (4 females, 3 males) acute cases, on the other hand, a rise in CK levels was noted due to the destruction of muscle tissue.

It was observed that the liver was herniated in all of the cases. Additionally, stomach, omentum, and small intestines were among the most frequently herniated organs. The slit of the diaphragm was at the diaphragm-costa attachment site in 30 cases (right site in 17, left site in 13 cases) and at the hiatus level in 14 cases. Thoracic fluid accumulation was noted in 12 of the cases due to venous stasis.

Three of the cases were lost during the operation, two of these deaths were due to a failure in removing the excessive secretion from the respiratory system and the other due to a slit of the lungs caused by the application of too much pressure during the elimination of atelectasis.

Diaphragmatic hernia is one of the most frequently noted cases caused by trauma in cats (3, 5, 7, 8, 10). In the present study, congenital hernia was not observed. In all cases, however, a history for trauma was existent or signs of a recent trauma such as ecchimosis, wounds, and fractures were noted during the physical examination of the animals.

Although no known predilection was reported for diaphragmatic hernia in cats (3, 7), a great majority of our cases were cross breed cats (39 cases). As the genders of the patients were evaluated, it was observed that the number of the female cats (24) was slightly higher than the male cats (20). The disease was more common among younger aged cats (10 months of age on average) which is consistent with the previous literature (3, 5, 8).

Sick animals with a history of trauma and a complaint of respiratory difficulty should be evaluated for diaphragmatic hernia since these are the common symptoms for this disease (3, 5, 8). Radiographic examination, especially positive contrast celioghraphy, is strongly recommended for a definitive diagnosis (1, 3, 4, 8-10). However, it should be remembered that a diagnosis based on the passage of the contrasting substance to the thoracic cavity might be misleading if there are adhesions. In our study, we have only noted this in one case (fig. 5a-b).
The liver is the most frequently herniated organ and usually considered responsible for hydrothorax caused by the venous stasis of the organ. Fluid accumulation in the thoracic cavity was seen in 12 of the 44 cases in the current study. The increase in AST, ALT and GGT levels noted in 4 cases was thought to be a result of the liver being under pressure for a long time due to the chronic nature of the cases.

If the general condition of a patient is stable enough to allow surgery, the animal should be operated as soon as possible to prevent acute decompensation and potential lung edema that may develop postoperatively (3). However, it was reported that surgery within the first 24 h without stabilizing the patient may result in a higher mortality rate. Preoperative oxygen inhalation is essential for myocardial oxygenisation and the prevention of acidosis (3).

Use of prednisolon is recommended for the prevention of reexpansion edema (3). As the use of prednisolone was only a recommendation and since it was thought that this medication could have a detrimental effect on the healing of the wound, it was not considered to be suitable for use in this study. In this study, where thorax drainage was not essential (2, 3, 8) the procedure was not carried out post-operatively in any of the cases. No complication was observed within the follow up examinations of the first year.

Since cats with diaphragmatic hernia exhibit respiratory depression, they should not be anesthetized by combinations of preanesthetic (xylazine) and anesthetic (barbiturates) that may depress the respiratory system. Although the authors do not recommend using face masks for anesthetic induction (3, 6, 10), we have not encountered any difficulty or complications. Mortality rates in traumatic diaphragmatic hernia cases vary from 12 to 48% (3, 7, 8). The mortality rate was 6.8% in this study, which is lower than the average.

As a result, in stabilized cat patients with diaphragmatic hernia, the success of the surgery may be increased by anesthesia initiated by mask induction followed by the use of isoflurane via entubation.

References

Author’s address: Dr. Ozlem Guzel DVM, PhD, Surgery Department, Faculty of Veterinary Medicine, Istanbul University, 34320, Avciar-Istanbul/Turkey; e-mail: drozlemguzel@gmail.com, d roguzel@istanbul.edu.tr