



ACUTE TRAUMATIC DIAPHRAGMATIC HERNIA AND POSTOPERATIVE PNEUMOTHORAX IN A MONGREL PUPPY

^aS. Anoop, ^{b*}Sherin B. Sarangom, ^aK. M. Dileep Kumar, ^cJinu John, ^dSyam K. Venugopal & ^aC. B. Devanand

^aDepartment of Veterinary Surgery and Radiology, CV&AS, Mannuthy, Thrissur, Kerala – 680 651

^bDivision of Surgery, ICAR-IVRI, Izzatnagar, Bareilly, U.P. – 243 122

^cVeterinary Hospital, Nilambur, Kerala – 679 329

^dUniversity Veterinary Hospital, KVASU, Kokkalai, Thrissur, Kerala – 680 021

*Corresponding author: Sherin B. Sarangom, email - sbs04vet@gmail.com

ABSTRACT

Acute traumatic diaphragmatic hernia was diagnosed by radiographic and ultrasonographic examination in a 42-day-old Mongrel puppy presented with severe dyspnoea following an automobile accident. The owner's primary complaint was limping. Herniorrhaphy was performed after post-xiphoid coeliotomy under general anaesthesia and intermittent positive-pressure ventilation using a time-cycled ventilator. Postoperative radiograph showed re-established diaphragmatic silhouette along with repositioned abdominal organs, but pneumothorax was evident. Gradual decompression was done by thoracentesis using over-the-needle catheter connected to a three-way tap. The concurrent right femur fracture was left unrepaired until necessitated. Post-operative medications were given and the puppy recovered without any complications.

KEYWORDS: Diaphragmatic hernia, Pneumothorax, dog

INTRODUCTION

Diaphragmatic hernia (DH) in puppies is often congenital rather than acquired (Gibson *et al.*, 2005 and Burns *et al.*, 2013). Traumatic DH is a surgical emergency and the prognosis may vary in dogs, yielding to pre-, peri- and post-operative complications (Sullivan and Reid, 1990). In contrast to congenital DHs in puppies, survival rates following repair of traumatic DHs in dogs is less and is further exacerbated by concurrent injuries (Gibson *et al.*, 2005 and Burns *et al.*, 2013). Pneumothorax has been reported to be a common complication following repair of chronic DH in dogs (Minihan *et al.*, 2004). The present case report describes acute traumatic DH in a puppy with concurrent femur fracture that developed postoperative pneumothorax and its successful management.

Case history and observations

A 42-day-old male, Mongrel puppy weighing 4.5 kg was presented for limping of right hind limb immediately after an automobile accident. On clinical examination, the puppy showed severe dyspnoea and appeared dull and depressed. The rectal temperature and heart rate were normal. The pulse was strong and regular. The conjunctival mucous membrane was pale and the capillary refill time was <2 sec. Auscultation of left side of chest showed enhanced respiratory sounds and the opposite side revealed typical intestinal sounds. Upon cardiac auscultation, muffled heart

sounds were detected. The right lateral whole body radiograph revealed an obscured diaphragmatic silhouette with gas filled bowels along with stomach and liver overlying a substantially enlarged cardiac silhouette in the thorax (Fig. 1). Both the anterior and posterior borders of cardiac silhouette were blurred with dorsally elevated trachea. A simple mid-diaphyseal fracture of right femur was also observed. Ventro-dorsal radiograph showed rupture of right hemidiaphragm (Fig. 2). Ultrasonographic evaluation in parasternal projections identified hepatic parenchyma, spleen, stomach and small intestine in the thoracic cavity. The findings confirmed an acute traumatic DH. Complete hematology and serum biochemistry showed no abnormalities. Haemogram showed negative status for blood protozoa or rickettsia.



FIGURE 1: Radiograph showing incomplete diaphragmatic silhouette



FIGURE 2: Rupture of right hemidiaphragm

Treatment and outcome

Herniorrhaphy was done after 24 hrs once the puppy attained stable cardiopulmonary function. Preoperatively, ceftriaxone 25 mg/kg body weight (bwt) i.v. and tramadol 4 mg/kg bwt i.v. were given. After premedication with atropine sulphate at 0.045 mg/kg bwt i.m., anaesthesia was induced with diazepam 0.27 mg/kg bwt i.v. and ketamine 5.5 mg/kg bwt i.v. and was maintained with 2% isoflurane in oxygen. Intermittent positive-pressure ventilation (IPPV) was given using a time-cycled ventilator (15 breaths/min, I:E ratio = 1:3, 700 mL, 10cm H₂O) to achieve a target end-tidal CO₂ between 35 to 45 mmHg. Perioperatively, Ringer's Lactate at 5 mL/kg/hr i.v. was given. The diaphragm was approached through midline post-xiphoid coeliotomy and a 6 cm long tear along the right hemidiaphragm with displaced liver, intestine, spleen omentum and stomach in thoracic cavity was identified. Herniated viscera were free from adhesions and fibrin deposition. The abdominal organs were gently replaced and the tear was sutured in simple continuous lock stitch pattern using 2-0 USP polyglactin 910. Ventral diaphragm was fixed onto manubrium sterni. The lungs were hyper inflated before placing final suture on diaphragm. Spontaneous ventilation regained once the respiratory rate was reduced and IPPV was discontinued. The coeliotomy wound was closed routinely. Anesthetic time was approximately 20 minutes and the vital parameters remained within clinically acceptable limits. Following extubation, oxygen was delivered *via* face mask. The anesthetic recovery was uneventful. Postoperative radiograph showed re-established diaphragmatic silhouette along with repositioned abdominal organs, but pneumothorax was evident characterized by an elevated heart and partially collapsed radiopaque lung that had retracted from the chest wall (Fig. 3).



FIGURE 3: Immediate postoperative radiograph

Gradual decompression by thoracentesis at 7th intercostal space was done using an over-the-needle catheter coupled three-way tap to remove nearly 70 mL of air. The puppy was monitored for any further accumulation of air in the thoracic cavity. The femur fracture was allowed to heal under callus and was left unrepaired until necessitated. Cage rest was advised for 3 weeks. Antibiotics, analgesics, prokinetics and bronchodilators were given post-surgery. Upon observation on 2nd post-operative day, puppy was bright and active. Thoracic auscultation showed normal cardiac and lung sounds on both sides of the chest. Based on perioperative surgical evaluation and postoperative clinical response, the prognosis was assessed to be good. Radiographic examination on the 7th postoperative day showed normal cardiac silhouette and air filled lungs without any further complications (Fig. 4). Skin sutures were removed on the 10th postoperative day.



Figure 4: Radiograph on 7th postoperative day

DISCUSSION

Traumatic DHs are rarely reported in puppies than in adult dogs (Sullivan and Reid, 1990). Hernias of traumatic origin often accompany concurrent injuries (Gibson *et al.*, 2005), and the fractured limb was the primary concern for the owner. Severe dyspnoea and shallow breathing noticed during clinical examination along with the hallmark radiographic signs of DH led to diagnosis. An immediate surgical intervention was attempted within 24 hrs of admission looking forward to better prognosis (Gibson *et al.*, 2005), after adequate cage rest and stabilization. The perioperative anaesthesia was supported by a mechanical ventilator and the lungs were hyper inflated immediately before the placement of last sutures on the diaphragm, but it was unfortunate that the puppy developed pneumothorax. Rather than postsurgical pneumothorax, the possibility of any traumatic and iatrogenic rupture of lung and air leakage was our concern that was ruled out later. Different techniques such as thoracentesis and tube thoracostomy has been recommended in patients depending on the rate of accumulation of air in the thoracic cavity and even pleurodesis, but varied in anticipated complications (Rinaldi *et al.*, 2009). Rapid centesis of trapped air was not attempted to enable gradual expansion of atelectic lungs and thereby to reduce chances of potentially lethal re-expansion pulmonary oedema (Conen *et al.*, 2007). Even, tidal volume of gas was delivered at a lower rate during anaesthesia for the same reason. Nevertheless, herniorrhaphy induced postsurgical

pneumothorax in acute DH can be managed by thoracentesis alone.

REFERENCES

- Burns, C. G., Bergh, M. S. and McLoughlin, M. A. (2013) Surgical and nonsurgical treatment of peritoneopericardial diaphragmatic hernia in dogs and cats: 58 cases (1999-2008). *J. Am. Vet. Med. Assoc.* 242, 643-650.
- Conen, A., Joos, L. and Bingisser, R. (2007) Ipsilateral reexpansion pulmonary edema after drainage of a spontaneous pneumothorax: a case report. *J. Med. Case Reports* 1, 107.
- Gibson, T. W. G., Brisson, B. A. and Sears, W. (2005) Perioperative survival rates after surgery for diaphragmatic hernia in dogs and cats: 92 cases (1990-2002). *J. Am. Vet. Med. Assoc.* 227, 105-109.
- Minihan, A. C., Berg, J. and Evans, K. L. (2004) Chronic Diaphragmatic Hernia in 34 Dogs and 16 Cats. *J. Am. Anim. Hosp. Assoc.* 40, 51-63.
- Rinaldi, S., Felton, T. and Bentley, A. (2009) Blood pleurodesis for the medical management of pneumothorax. *Thorax* 64, 258-260.
- Sullivan, M. and Reid, J. (1990) Management of 60 cases of diaphragmatic rupture. *J. Small Anim. Pract.* 31, 425-430.