Journal of Animal and Veterinary Advances 18 (2): 42-47, 2019
ISSN: 1680-5593

Thoracic Injury in 8 Dogs and 8 Cats

Murat Caliskan, Pinar Can and Omer Besalti
Department of Surgery, Faculty of Veterinary, University of Ankara, Ankara, Turkey

Abstract: The objective of this study was to determine clinical, radiographical and surgical findings and outcome of severe thoracic injuries in dogs and cats. The 16 animals were included in the study (8 dogs and 8 cats); 7 of which presented with bite wounds, 5 with impalement injuries, 2 with traffic accidents and 2 with penetration wounds associated with sharp objects. Thoracic cavity was penetrated in 14 cases whereas such penetration was noted both in abdominal and thoracic cavities in 2 cases. All patients that were exposed to dog attacks were small breed dogs or cats. The most common radiographic findings were subcutaneus emphysema, pneumothorax and rib seperation which were also confirmed during surgical approach. Conducted surgical treatment consisted of debridement and wound reparation by single or multiple thoracotomies. The 11 animals survived treatment and had good outcomes, however, 5 animals died after surgical intervention. In conclusion, thoracic traumas are life threatening cases and require immediate intervention in cats and dogs. The survival rate of the cases is related to the severity of the trauma as well as the emergency intervention.

Key words: Cat, dog, surgery, thorax, thoracotomies, survival

INTRODUCTION

Thoracic injuries are common in dogs and cats. The most common causes of thoracic trauma can be listed as traffic accidents, being bitten by other animals, gunshot wounds and impalement injuries. Impalement injuries are defined as piercing or transfixation with a sharp object. There is limited literature about this kind of injury in veterinary medicine. In human medicine, some researchers advice that the penetrating object must be left in position on the patient until reference to a hospital. Impalement injuries are clasified as type 1 (impact between the patient body and immobile object) and type 2 (mobile object impacting a stationary patient) in human medicine (Eachempati *et al*., 1999). In veterinary medicine, impalement injuries on dogs most commonly involve head, neck or cranial thorax. Involvement of impalement injuries can be misleading and life threatening due to the simplicity of the entrance wound, limited wound exploration and associated internal injury. Recommended choices of treatment are surgical exploration and debridement of the wound entry. (Menard and Schoefflerm, 2011).

Bite wounds are the most common cause of thoracic trauma in dogs and cats. Cats subjected to dog bites present with multiple serious problems related to thoracic injury which may also be accompanied by orthopedic and neurologic injuries. Dog bite wounds may accur as minor to moderate in complexity. The appearance of skin lesion can be misleading in most cases. Subdermal profound tissues, large amount of muscles, vasculature and internal organs are often damaged without visible skin defects due to combination of shearing, tensile and compressive forces of bite and mobility of overlying skin (Shamir *et al*., 2002; Scheepens *et al*., 2006). On physical examination; dyspnea, abdominal respiration, open wounds, thoracic asymmetry and flail chest can be observed. Severe thoracic injuries can be life threating, therefore immediate intervention may be necessary. There is no standart treatment protocol for bite wounds in dogs and cats (Shamir *et al*., 2002). However, some researchers advise selection of more conservative choices of treatment, such as wound care and prophylactic antibiotics (McKiernan *et al*., 1984; Davidson, 1998). Recent literature points to exploratory surgery of all thoracic bite wounds, following clinical and radiological examinations (Holt and Griffin, 2000; Shamir *et al*., 2002). Surgical debridement, lavage and pressure irrigation are strongly recommended for removal of devitalized tissue in human and veterinary medicine (Waldron and Trevor 1993; Shahar *et al*., 1997).

The aim of this study is to describe clinical, radiological and surgical intervention findings of severe thoracic trauma in dogs and cats and to compare the relationship between the severity of the injury and outcome after surgical intervention.

Corresponding Author: Murat Caliskan, Department of Surgery, Faculty of Veterinary, University of Ankara, Ankara, Turkey

Table 1: Complicantions and survival rates

Signalement	Causes of thoracic ratuma	Physical findings	Radio graphical findings	Surgery	Intraoperative findings	Complications	Outcome
Cat Mix breed F 10 months 2 kg	Bite trauma	Abdominal respiration dysponoea subctaneous emphysema small tooth marks on the thorax Ambulatory	Hernia diaphramatic 2-4th costochondral Seperation	Ventral laparatomy Wound debidement	Diaphram laceration (11-6 direction) Herniated organs: Liver, small intestine stomach, mesentery diaphram repaired with prolen 3/0 and thorax injury fixed 2/0 prolene		Intraoperative cardiac arrest Ex
Cat Mix breed F 4 years 4 kg	Bite trauma	Dyspnoea Abdomninal respiration Left thorax Deformation	Left 4-6th rib fracture	Left lateral toracotomy	Left 4-6th rib fracture and separation in intercostal muscles Repaired with 2/0 prolene	Wound dehisdence requering open wound management	Good
Dog Mix breed M 1 year	Bite trauma	Fail chest thorax and abdominal open woun	Bilateralo 5-7th rib fracture	Right and left lateral toractomy	Bilateral 5-7th rib fracture and separation in intercostal muscles, Hemothorax Repaired with 0 prolene, hemothorax suctioned and thoracic draine performed (Foley catheter)		Good
Cat Mix breed M 1 year 3 kg	Bite trauma	Thorax open wound schock Non-ambulatoric	No X-ray taken because of emergency	Ventral toracotomy and sternotomy	Severe lung injury and hemothorax		Intraoperative Ex
Dog Pekingese F 5 years 5 kg	Bite trauma	Thorax open Ambulatory Dysponea Subcuaneous emphysema	8-11 th rib fracture Subcutaneues emphysema	Right lateral toractomy	Thorax repaired with 0 prolane, thoracic draine performed (Foleyb Catheter) 10 days	Pyothorax Treated with thoracic lavage and IV seftriassone+flagyl	Good
Dog Golden Retriever M 5 year 30 kg	Traffic accident	Abdominal respiration Dyysponea Subctuaneous emphysema Flail chest Ambulatory	Left 5-10 th rib fracture	Left lateral toractomy	5-10 th rib fracure and seperation, severe intercostal musle seperation. hemothorax and moderate lung injury hemothorax suchtioned and thorax repaired with no 1 Prolene structure material Rib fractures fixed with cerilage wire	Good	
Cat Mix breed F 4 years 3, 5 kg	Traffic accident	Abdominal ventilation Ambulatory	Hernia diaphramatica Right rib fracture (10-13)	Ventral laparotomy right toracotomy	Diaphram laceration (10-14 direction) 10-13 th costachondral fracture and seperation Herniated organs: Liver, small intestine, mesentery Diaphram repaired with prolen 3/0 and thorax injury sutured with 2/0 prolene		Good
Cat M 2 years 3 kg	Implament injury (iron bar)	Open wound at right lateral chest wall Non ambulatory	No X-ray taken because of of emergency	Right lateral toracotomy	Lung injury, hemothorax		Ex during surgery
Dog Mix breed F 6 years 25 kg	Cutting object	Penetreous wound to chest cavity behind left scapula Ambulatory	Pneumothorax 10-12 th rib fracture	Left lateral toracotomy	Rib fractures fixed with No 1 prolene suture material open wound irrigated and closed		Good
Dog Mix breed M 8 years 35 kg	Implament injury (iron bar)	Abdominal respiration open wound behind sternum and invased to abdomen	Pneumothorax	Ventral laparotomy	The defect on the diaphragm and chest wall was repaired with No. 1 prolene suture material		Good

Table 1: Continue

Signalement	Causes of thoracic ratuma	Physical findings	Radio graphical findings	Surgery	Intraoperative findings	Complications	Outcome
		and thorax					
Cat Mix M 3 years 4 kg	Bite trauma	Abdominal respiration Non-ambulatoric Multiple open wounds on abdomen and thorax Right abdominal evantration	No X-ray taken because of emergency	Right lateral toracotomy, open wounds sutured	Severe intercostal muscle seperation flail chest multipl open wounds on thorax and abdomen evantration at right site Necrotic mezenterium removed and small intestines placed abdomen		Ex
Cat Mix F 2 years 3.5 kg	Bite trauma	Abdominal respiration Dyspnoea Subcutaneous emphysema-small tooth marks on the thorax-Ambulatory	Hernia diaphramatica	Ventral laparotomy	Diaphram laceration (10-6 direction) Herniated organs: Liver, small intestine, spleen, stomach, mesentery Diaphram repaired with prolen 3/0 and thorax injury fixed with 2/0 prolene		Good
Dog Mix M 5 years 2o kg	Implament injury (iron bar)	Abdominal respiration iron bar on right thorax Non-ambulatory	No X-ray taken because of emergency	Right lateral toracotomy	Hemothorax, lung injury open wound on thorax repaired with no 1 propylen suture material Thoracic drain performed (Foley catheter)		Good
Dog Pincher M 4 years 3 kg	Cutting object	Abdominal respiration Ambulatory Open wound on right thorax thoracic drainage	No X-ray taken because of emergency	Right lateral toracotomy	Hemothorax, 8-12 th rib fracture and sever intercostal muscle seperation	Pleural effusion after 2 weeks of the operation. Folley catheter placed to perform	Good
Cat Mix breed F 2 years 2.5 kg	Implament injury (iron bar)	Abdominal respiration Dyspnea open wound on bilateral thoracic wall	No X-ray taken because of emergency	Bilateral lateral toracotomy	Hemoabdomen 2 iron bar penetration on lateral thorax		Ex
Dog M 5years 27 kg	Implament injury (iron bar)	Dyspnea	Pneumothorax	Toracotomy	Iron bar penetration to thorax		Good

MATERIALS AND METHODS

The medical records of 16 animals which underwent surgical intervention due to thoracic trauma between December 2012 and February 2017, reviewed. Inclusion criteria was the cases with just thoracic trauma treated surgically without diaphramatic hernia, spinal trauma, appendicular fracture and traumatic brain injury and admitted to clinic <8 h. Data retrieved from records as; age, sex, etiology of trauma and physical examination and neurological findings, radiographic findings, employed surgical technique, intraoperative findings and anesthesia and analgesia protocols. Complications and survival rates also evaluated (Table 1).

All cases subjected to emergency procedure to stabilize the general situation and evaluated clinical examination. Abdominal and thoracic radiography taken to evaluate thorax. In impalement injuries, the impalement

Fig. 1: Impalement injury in a dog with steel bar

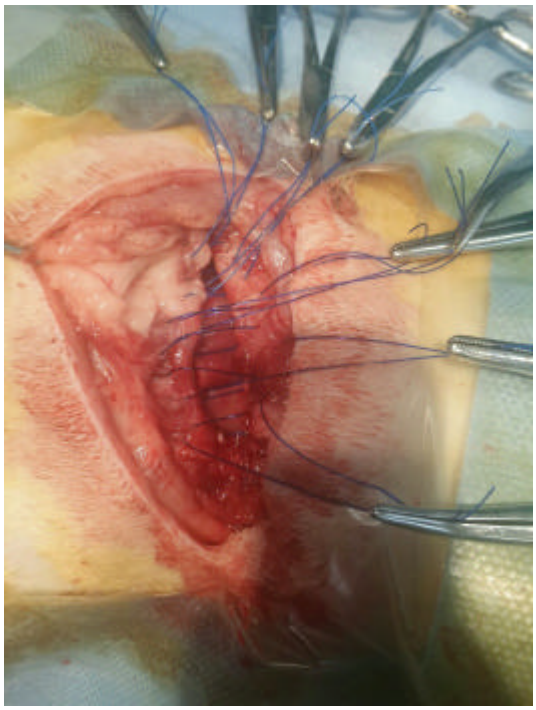

Fig. 2: Reparing of injured area with propylene suture material in cat (case 2)

material not removed before the surgery (Fig. 1). The animals admitted to the hospital after cutting the implated object as soon as possible. After stabilisation of the animal they operated according to the affected region.

Operation site clipped widely, cleaned with antiseptic solutions and prepared for aseptic surgery. Unilateral or bilateral toracotomy, median toracotomy and celiotomy performed alone or combined after debridement of open wounds. The pleural cavity was lavaged with warm sterile saline, controlled to any air leaks and than after suctioned. Pleural space aspirated via. Needle thoracocentesis to provide negative pressure. In the injured area, fractured rib was repaired by kischner wire in dogs and propylene suture materials in cats (Fig. 2), thoracotomy wounds closed with ethilon (no:0) by the interrupted sutures. Skin and subcutaneous tissues were closed as routine manner.

Cefazolin sodium (20 mg/kg IV) administered before anesthesia for prophylaxis. In all cases, general anesthesia was performed via induction with propofol (4-6 mg/kg IV), followed by tracheaal intubation and deep anesthesia was initiated and maintained with isoflurane (2-3.5%) in oxygen. Continuous Mandatory Ventilation (CMV) or Pressure-Controlled Ventilation (PCV) were applied during surgery. For analgesia, Fentanyl citrate was given as Continuous Rate Infusion (CRI) and intercostal bupivacaine was used. During the postoperative period, fentanyl patch, morphine or NSAID's (Meloxicam) were used for analgesia according to general condition of animals and wide spectrum antibiotics were administered.

Cases were discharged from hospital after clinical improvement and followed by the clinical examinations and telephone conversations.

RESULTS AND DISCUSSION

The 16 animals (8 dogs and 8 cats) met the inclusion criteria in this study. Cats were 5 female and 3 males and the dogs; 6 male and 2 females. Mean age of cats was 28.25 months (10-48 months) and mean body weight was 2.6 kg (2-4 kg). Mean age of dogs was 4.8 years (10 months-8 years old) and mean body weight was 19.1 kg (3-35 kg). Causes of thoracic trauma were distributed as 7 bite wounds, 5 impalement injuries, 2 traffic accidents and 2 sharp object injuries. Only thoracic cavity was affected in 14 cases whereas both abdominal and thoracic cavities were involved in the trauma in 2 cases. Eleven cases survived without problems and 3 of 7 bite wound cases and 2 of 5 impalement cases died after surgery.

Bite injuries: These injuries were result of attacks by other dogs in 5 cats and 2 small breed dogs. Lateral toracotomy was performed in 2 cats and 2 dogs, 1 cat had lateral toracotomy and sternotomy, 2 cats had wound debridement and ventral laparotomy. The most common clinical and physical examination findings were dysepnea in all affected animals and abdominal respiration, open mouth breathing in cats. In all bite wound cases, many small tooth marks on the thorax and abdomen, open wounds and subcutaneus emphysema were observed. Flail chest was present in 3 of 7 cases. All these 7 cases required emergency treatment. After animals were stabilized, thoracic radiographs were taken. On radiographs rib fractures, rib seperations, subcutaneus emphysema, pneumothorax were observed (Fig. 3). In 2 of the 5 cats, diaphragmatic hernia was also evident. Intraoperative findings were in correlation with radiographs.

Bite wound areas examined though a dorsal to ventral incision, made directly over the wound site and sterile guides were used to predict wound depth. Foreign bodies and devitalized subcutaneus tissues were removed and muscles debridement was performed. Pleural cavity was inspected for presence of any lung damage. There was no lung damage in 7 cases but in 2 cases hemothorax was seen.

Fig. 3: Severe subcutaneus emphysema after bite injury in a dog (case 5)

Impalement injuries: The 2 cats and 3 dogs presented with impalement injuries with iron rods as acusing factor. Lateral toracotomy was performed in 1 cat and 2 dogs, 1 cat and 1 dog went under ventral laparotomy. In all cases, there were open entrance and exit wounds on the skin of the animals. Because of the tamponade effect of implanting objects, iron rods were not mobilized or removed until surgical procedures. After stabilization of these cases, general anesthesia was induced with propofol and animals were intubated and maintaned on isofluran 2-3% in oxygen. Iron rods were removed slowly with great care and operation sites were controlled for bleeding. Foreing bodies which entered the body during skin perforation were removed from the wound. When necessary, the inlet and outlet wound holes were enlarged and bilateral or unilateral torocatomies were performed.

Sharp object injuries: The 2 dogs had sharp object injuries on thoracic region. There were open wounds which were formed by unknown persons because of suspected knife stabbing through the chest area. Clinically, penetring wounds into the chest cavity an open wounds were observed. Lateral thoracotomy was performed, rib fractures were fixed and devitalized tissues were debridated. Pleural cavity was irrigated with isotonic saline and chest catheter was kept for three days. In one dog pyothorax devoleped 15 days after the operation and was treated successfully with thoracosynthesis and intravenous ceftriaxone and metronidazole administration for 10 days.

Traffic accident injuries: One dog and one cat had thorax injuries due to traffic accidents. Rib fracture, severe intercostal muscle seperation, hemothorax, moderate lung injury were seen in the cat. Rib fractures in the dog were fixed with cerclage wire and in the cat with prolene (no:2/0). Postoperative outcome was favorable and healing period was completed without any complication.

The causes of death after or during operation were cardiac arrest in 5 cases dring operation and not recovering from anesthesia and progress to late compensatory shock in these cases.

Thoracic injury is one of the common disorder in emergency cases, with a high morbidity and mortality. In this case series the survival time is 68.75% and the mortality rate was 31.25%. Even though the mortality rate found as related to severity of injury it was emphasized that the emergency intervention and surgical treatments are crucial for survival. Thoracic injuries are common in both dogs and cats living outdoor due to traffic accidents, bite wounds, gun shot wounds and penetrating foreign bodies (Scheepens *et al*., 2006). In the present study, 43.75% of the cases suffered from bite wounds, 12.5% from traffic accidents, 31.25% from penetrating foreign bodies and 12.5% from cuts. In all cases reviewed, dyspnea and abdominal respiration were the most common clinical findings. In addition, subdermal emphysema and flail chest symptoms were seen in rib fracture cases.

Bite wounds are more common in dogs and cats and more complicated than other types of wounds (Davidson, 1998). In this study, 5 of the bitten cases are cats and 2 of them small breed dogs. Shamir *et al*. (2002) and Scheepens *et al*. (2006) demonstrated that small breed dogs have higher risk of being bitten by other dogs, so that, higher risk of flail chests, lung contusions and mortality rate. Our findings were in line with this study as small-sized animals had a higher risk of being bitten by other dogs. In all bite wound cases abdominal respiration, dispnea, subdermal emphysema and open mouth breathing were noted and in three cases, flail chest was seen clinically. Radiological findings showed that 22.2% (2 cats) of the cases had diaphragmatic hernia, 44.44% (2 cats and 2 dogs) had rib fractures and 12.5% (2 dogs) had subcutaneus emphysema. In severe thoracic injuries thoracotomy application is adviced for surgical exploration of the bite wounds by some researchers (Holt and Griffin, 2000; Shamir *et al*., 2002). This study confirms this suggestion. In some cases we prefered cage rest and conservative therapy. Amoxicillin clavunate was the preferred antibiotic for oral intake, bite wounds were cleaned with antiseptic solutions dailly and antibiotic pomads used to cover the affected areas. However, in multifocally injuried cases, multiple toracotomies and/or laparotomies were performed.

Impalement injury is an uncommon cause of thoracic trauma in veterinary practice in which most common cause of penetration is a wooden object, as foreign body (Matiasovic *et al*., 2018). Nevertheless, these kinds of injuries are the most severe types of penetrating trauma

injuries in human medicine and also in veterinary practice which are prone to involve vital organs therefore mortality rate is expected to be extremly high (Kim and Seo, 2016). Previous reports in human medicine and in veterinary medicine suggest not to manipulate the impaled object (Matiasovic *et al*., 2018). All of our cases with impalement injuries (3 cats and 2 dogs) were penetrated by iron rod from the garden. These cases were stable enough to transport to the faculty clinic by owners after cutting the iron bar tips. Because of tamponade effect, very small amount of bleeding was observed. 2 dogs and 1 cat had bilateral thoracic impalement, through mediastinum and were operated successfully, however, 2 cats died after surgery because of severe lung injury.

The radiographic findings of cases demonstrated one or more radiographical anormalities. When radiographical findings were compared with surgical findings it was seen clearly that some pathologic anormalities like intercostal muscle distruption could not be diagnosed radiographically. However, intercostal muscle distrubtions were noted in the thoracic wall of all cases treated surgically. In addition, laterolateral position is mostly insufficient for evaluation of rib fractures therefore ventro dorsal position must also be taken. Rib separation, fractures and subcutaneus emphysema were the most common radiographic abnormalities, followed by pneumothorax and hemothorax. In impalement injury cases, due to the risk of further damage during positioning of the animal, radiographic examination was not performed.

CONCLUSION

Limitations we have faced during the course of the study were wide range of variations among types of cases, together with uncontrollable data, limited number of cases and difficulties in case grouping in relation. Nevertheless, thoracic traumas are life threatening and require intervention as medical treatment in cats and dogs. The survival rate of cases with thoracic injury is closely related to the immediate intervention and proper intensive care.

REFERENCES

Davidson, E.B., 1998. Managing bite wounds in dogs and cats-Part I. Compend. Continuing Educ. Practicing Veterinarian, 20: 811-820.

Eachempati, S.R., P.S. Barie and R.L. Reed, 1999. Survival after transabdominal impalement from a construction injury: A review of the management of impalement injuries. J. Trauma Acute Care Surg., 47: 864-866.

Holt, D.E. and G. Griffin, 2000. Bite wounds in dogs and cats. Vet. Clin. Small Anim. Pract., 30: 669-679.

Kim, K.T. and P.W. Seo, 2016. A case of severe thoracoabdominal impalement by a steel bar. Korean J. Thoracic Cardiovasc. Surg., 49: 481-484.

Matiasovic, M., Z.J. Halfacree, A. Moores, P. Nelissen and S. Woods *et al*., 2018. Surgical management of impalement injuries to the trunk of dogs: A multicentre retrospective study. J. Small Anim. Pract., 59: 139-146.

McKiernan, B.C., W.M. Adams and D.C. Huse, 1984. Thoracic bite wounds and associated internal injury in 11 dogs and 1 cat. J. Am. Vet. Med. Assoc., 184: 959-964.

Menard, J. and G.L. Schoeffler, 2011. Colonic, ureteral and vascular injuries secondary to stick impalement in a dog. J. Vet. Emergency Crit. Care, 21: 387-394.

Scheepens, E.T.F., M.E. Peeters, H.F. L'eplattenier and J. Kirpensteijn, 2006. Thoracic bite trauma in dogs: A comparison of clinical and radiological parameters with surgical results. J. Small Anim. Pract., 47: 721-726.

Shahar, R., M. Shamir and D.E. Johnston, 1997. A technique for management of bite wounds of the thoracic wall in small dogs. Vet. Surg., 26: 45-50.

Shamir, M.H., S. Leisner, E. Klement, E. Gonen and D.E. Johnston, 2002. Dog bite wounds in dogs and cats: A retrospective study of 196 cases. J. Vet. Med. Ser. A., 49: 107-112.

Waldron, D.R. and P. Trevor, 1993. Management of Superficial Skin Wounds. In: Textbook of Small Animal Surgery, Slatter, D.H. (Ed.). W.B. Saunders, Philadelphia, Pennsylvania, USA., pp: 269-280.