

The Treatment of Tracheal Rupture and Generalized Subcutaneous Emphysema in A Dog

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ABSTRACT

Potentially life-threatening tracheal injuries are not commonly observed in dogs and usually occur due to bite wounds, gunshot wounds, and collar-chain injuries that form on the cervical part of the trachea, and are an important type of wound that requires surgical intervention. The defect in the trachea should be repaired with surgical interventions. If this defect is not repaired, secondary subcutaneous emphysema occurs. The subcutaneous emphysema that develops may be limited to the perithracheal region only or may spread to all subcutaneous areas of the body. This case report presents the diagnosis and treatment of a dog with tracheal rupture and generalized emphysema, associated with dog fight.

Keywords: Dog, emphysema, tracheal rupture

Bir Köpekte Trahea Rupturu ve Generalize Subkutan Amfizemin Tedavisi

ÖZ

Potansiyel olarak hayati risk taşıyan trahea yırtıkları köpeklerde yaygın olarak gözlenmez ve genellikle traheanın servikal kısmında şekillenen ısırık yaraları, ateşli silah yaralanmaları ve tasma-zincir yaralanmalarına bağlı olarak ortaya çıkar ve cerrahi müdahale gerektiren önemli bir yara çeşididir. Traheadaki defekt operatif müdahaleler ile onarılmalıdır. Bu defekt onarılmaz ise sekonder olarak subkutanöz amfizem meydana gelir. Şekillenen subkutanöz amfizem sadece peritraheal bölgede sınırlı kalabilir ya da vücudun bütün subkutanöz alanlarına yayılabilir. Bu vaka takdimi köpek kavgası ilişkili traheal ruptur ve generalize amfizem tespit edilen bir köpeğin tanısı ve tedavisini ortaya koymak amacıyla yapılmıştır.

Anahtar Kelimeler: Amfizem, köpek, traheal ruptur

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INTRODUCTION

Tracheal injuries are a rare and potentially life-threatening wound that requires surgical intervention (Kellagher and White, 1987; Rousie et al., 2004). It occurs due to bite wounds, gunshot injuries, and collar-chain injuries, which generally take place in the cervical part of the trachea (Kellagher and White 1987; Nikahval et al. 2015). It can also be formed as a complication of endotracheal intubation (Hardie et al. 1999; Mitchell et al. 2000; Kastner et al. 2004). It has been reported that such injuries in wild animals occur mostly as a result of car accidents and animal fights (Kumar et al. 2016).

Owing to the intraluminal accumulation of blood and tissue debris caused by severe injuries and tracheal displacement, obstruction in the respiratory tract and respiratory failure occurs. Eventually, death may be a consequence (Kellagher and White 1987; Basdoni et al. 2016). Where necessary, tracheotomy should be performed for emergency intervention (Kellagher and White 1987). The defect in the trachea is repaired with surgical management (Rousie et al. 2004). If not repaired, secondary subcutaneous emphysema takes place. The developing subcutaneous emphysema may be limited only to the perithracheal region or spread to all subcutaneous areas of the body. Diagnosis is made by anamnesis, clinical findings, and lateral cervical radiography (Bauer and Currie, 1988; Nikonval et al. 2015; Kumar et al. 2016).

CASE HISTORY

A 2-year-old male 25,7 kg cross-breed dog was presented to the small animal veterinary clinic, Application and Research Center of Veterinary Health, University of Afyonkocatepe. The owner of the dog stated that the dog was bitten by another dog two days before admission, and swelling was formed all over his body. As a result of the clinical examinations, the body temperature was 38.9°C, the respiratory rate and heart rate per minute were 60 and 88, respectively. Bite wound on the neck (Figure 2) and generalized subcutaneous emphysema covering the neck and cranial part of thorax particularly around both scapulas were detected (Figure 1). A complete blood count (HumaCount 80TS, Vet Mode, Germany) was measured (Table 1). Radiographic examination revealed a rupture in the cervical region of the trachea and subcutaneous emphysema (Figure 1). The dog treated with oxygen prior to surgical intervention. The animal was oro-tracheally intubated after induction with propofol. Anesthesia was maintained with 2.0% Isoflurane delivered in %100 oxygen. Dog was placed in the dorsal recumbency. The affected region of the neck was shaved and prepared for surgery following the aseptic technique. The trachea was reached by making an incision from the area where the wound was located. Bruises and bleeding in the sternocephalicus and sternohyoideus muscles were detected. Ruptured sixth tracheal ring and seventh tracheal ring were sutured together with absorbable suture material (2/0, Polyglycolic acid) by simple interrupted suture pattern. Muscles, subcutaneous tissue, and skin were closed routinely. In the postoperative period, Cefazolin sodium (25 mg/kg, BID, IM, 7 days, Meloxicam (0,2 mg/kg, SID, 3 days) and povidone-iodine (10%) solution for wound care were recommended. One week after the surgery, complete recovery was observed (Figure 3).

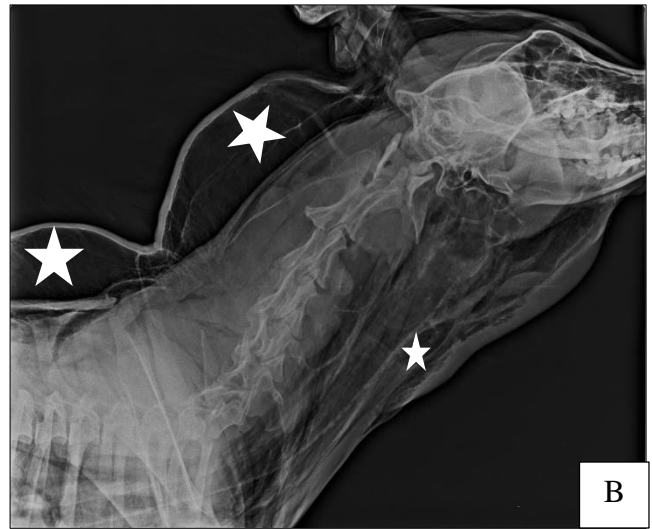
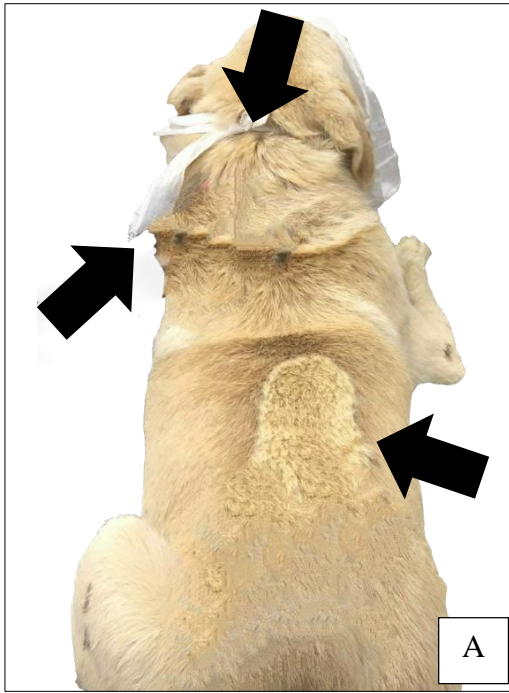


Figure 1: A. Preoperative clinical appearance of the dog (black arrows: generalized subcutaneous emphysema), **B.** Preoperative radiography (white asterisks: subcutaneous emphysema areas).

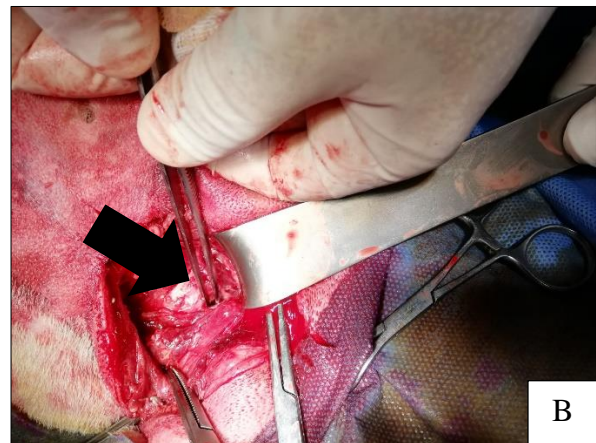


Figure 2: A. Bite wounds in the neck (black arrows) **B.** Tear in the trachea (black arrows)

Table 1. Complete blood count results

Complete Blood Count		
Parameter	Value	Reference range (Zimmerman et al. 2011)
WBC ($10^3/\mu\text{L}$)	10.38	6.00-17.00
Lymph ($10^3/\mu\text{L}$)	2.60	1.00-4.80
Mon ($10^3/\mu\text{L}$)	0.29	0.20-1.50
Gran ($10^3/\mu\text{L}$)	7.48	3.00-12.00
Lymph (%)	25.1	12.0-30.0
Mon (%)	2.8	2.0-4.0
Gran (%)	72.1	62.0-87.0
RBC ($10^6/\mu\text{L}$)	6.53	5.50-8.50
HGB (g/dL)	14.8	12.0-18.0
HCT (%)	39.68	37.00-55.00
MCV (fL)	60.7	60.0-77.0
MCH (pg)	22.7	19.5-24.5
MCHC (g/dL)	37.3	31.0-38.0
RDW (%)	12.6	
PLT ($10^3/\mu\text{L}$)	402	200-500
MPV (fL)	6.6	3.9-11.1
PDW (%)	36.6	
PCT (%)	0.27	



Figure 3: **A.** Clinical appearance of the dog on Postoperative 7th day, **B.** Lateral cervical radiography of the dog on Postoperative 7th day.

DISCUSSION and CONCLUSION

This case report was to evaluate the diagnosis and treatment of a dog with tracheal rupture and generalized subcutaneous emphysema.

Injuries that result in tracheal rupture are uncommon in dogs (Kellagher and White 1987), however penetrating injuries are among serious cases regardless of the cause (Risselada 2017). Tracheal rupture can be emergent event as a result of traumas formed in the cervical part of the trachea, and mostly seen as a result of bites during fights, injuries by firearms, car accidents, and excessive tightening of the leash chains (Kellagher and White 1987; Nikonval et al. 2015; Kumar et al. 2016). It has been reported that bite wounds as a result of fights mostly occur on the head and cervical areas (Basdani et al. 2016). Results of tracheal injuries vary according to the severity and location of the lesion. While crush wounds without penetration are not common and rarely cause acute respiratory obstruction, fractures in the tracheal rings can lead to life threatening chronic stenosis (Kellagher and White 1987).

Generalized subcutaneous emphysema can emerge by traumatic, iatrogenic, or spontaneous reasons, but tears in the tracheobronchial region often lead to generalized subcutaneous emphysema. In all animals with generalized subcutaneous emphysema, tracheal tears should be suspected as a cause (Bauer and Currie 1988; Nikonval et al. 2015). As a result of bite wounds, crushing, tearing, tissue loss, respiratory system problems can be detected. However, subcutaneous emphysema and later pneumomediastinum can be observed with respect to the air leaking from the perforated trachea reaching the paratracheal tissue. While subcutaneous emphysema can often be observed following such injuries, the extent of emphysema may be limited only to the surrounding tissues or spread to the whole body (Kellagher and White 1987; Risselada 2017). Subcutaneous emphysema and pneumomediastinum can also be observed when there is air leakage from the cervical trachea (Kellagher and White 1987).

Detection of tracheal perforations with subcutaneous emphysema can sometimes be difficult (Basdani et al. 2016), however, the diagnosis of tracheal rupture is easy, especially in cases with clear history. The presence of subcutaneous emphysema with progressive pneumomediastinum is a specific indicator of a leak in the upper respiratory tract. In cases of cough or whistling sounds, the location of the lesion can be determined by auscultation (Kellagher and White 1987). In cases where tracheal perforations are formed, direct or indirect paratracheal air accumulation, subcutaneous or deep facial emphysema, and pneumomediastinum may occur. Complete tracheal rupture or displacement can be seen in regional disorders (Basdani et al. 2016).

While the wound area can be detected clearly from the outside in patients, sometimes injuries may not be detected (Risselada 2017). Clinical findings include sudden onset of cough and difficulty in breathing (Rousie et al. 2004). Although large tears in the trachea can be seen on radiography, different diagnostic techniques can be used with radiography in minor injuries (Kellagher and White 1987). Radiography is the primary method that shows the degree of injury and tissue damage. Pleural effusion can be determined by ultrasonography of the thoracic region, but ultrasonographic imaging may be difficult due to the air in the subcutaneous tissue (Rousie et al. 2004; Risselada 2017). However, tracheal stenosis in the tracheal lumen can also be detected by positive contrast radiography or computed tomography (Basdani et al. 2016). In addition, it has been reported that it would be useful to detect foaming by pouring sterile 0.9% saline solution into the suspected area where the tracheal rupture is formed (Kumar et al. 2016). Obtaining latero-lateral and ventrodorsal radiographs of the cervical region, thorax, and abdominal region would be useful in detecting subcutaneous emphysema (Basdani et al. 2016).

Tracheal rupture requires urgent intervention and treatment should be initiated emergently (Kumar et al. 2016). Emergency surgery is the treatment of choice in most cases. Endotracheal intubation should be used when necessary (Rousie et al. 2004; Basdani et al. 2016; Manchi et al. 2016). While small, perforated wounds of the trachea can heal on their own, treatment can be performed by debridement of the underlying tissues with surgical interventions. However, the risk of stenosis can be reduced by resection and anastomosis of tracheal rings in large tear wounds or crush wounds (Kellagher and White 1987; Risselada 2017). In addition, the use of tissue adhesives can be used to remove small tracheal openings in acute conditions (Kumar et al. 2016). In addition, tears, tensions, bruises, losses in the skin and underlying tissues can be detected (Basdani et al. 2016). The split cartilage technique can be used to perform tracheal resection and anastomosis in severe cases. It has been reported that this technique is beneficial against the formation of stenosis (Basdani et al. 2016). In cases where lesions are larger than 2 cm and in cases with diffuse subcutaneous emphysema and respiratory distress, early surgical intervention is essential (Kastner et al. 2004). In medical treatment, it has been reported that continuous moistening of the respiratory tract and the use of broad-spectrum antibiotics would be beneficial (Rousie et al. 2004). In present case ruptured sixth tracheal ring and seventh tracheal ring were sutured together.

In this case report, uneventful recovery of a dog with a tracheal rupture as a result of surgical intervention was discussed.

Conflict of interest: The authors declared that there is no conflict of interest.

Ethical Approval: This study is not subject to the permission of HADYEK in accordance with the “Regulation on Working Procedures and Principles of Animal Experiments Ethics Committees” 8 (k). The data, information and documents presented in this article were obtained within the framework of academic and ethical rules.

REFERENCES

- Basdani E, Papazoglou LG, Patsikas MN, Kazakos GM, Adamama-Moraitou KK, Tsokataridis I.** Upper airway injury in dogs secondary to trauma: 10 dogs (2000-2011). *J Am Anim Hosp Assoc.* 2016; 52(5):291-296.
- Bauer MS, Currie J.** Generalized subcutaneous emphysema in a dog. *Can Vet J.* 1988; 29:836-837.
- Hardie EM, Spodnick GJ, Gilson SD, Benson JA, Hawkins, EC.** Tracheal rupture in cats: 16 cases (1983-1998). *J Am Vet Med Assoc.* 1999; 214(4):508-512.
- Kästner SB, Grundmann S, Bettschart-Wolfensberger R.** Unstable endobronchial intubation in a cat undergoing tracheal laceration repair. *Vet Anaesth Analg.* 2004; 31(3):227-230.
- Kellagher REB, White RAS.** Tracheal rupture in a dog. *J Small Anim Pract.* 1987; 28:29-38.
- Kumar PR, Sreenu M, Sailaja B, Raju DB.** Management of tracheal rupture in a pup with n-butyl cyanoacrylate glue - a case report. *J Livest Sci.* 2016; 7:192-195.
- Manchi G, Brunenberg MM, Shahid M, Aiyan AA, Brunenberg L, Stein S.** Larynx trauma and hyoid bone fracture after bite injury in dog: Case report. *Front vet sci.* 2016; 3(64):1-7.
- Mitchell SL, McCarthy R, Rudloff E, Pernell RT.** Tracheal rupture associated with intubation in cats: 20 cases (1996–1998). *J Am Vet Med Assoc.* 2000; 216(10):1592-1595.
- Nikahval B, Foroud M, Raayat JA, Ahrari-Khafi MS.** Generalized subcutaneous emphysema caused by concurrent cricoid cartilage fracture and cricotracheal detachment in a German shepherd dog. *Iran J Vet Res.* 2015; 16(2):226-228.
- Risselada M.** Perforating cervical, thoracic, and abdominal wounds. *Vet Clin Small Anim.* 2017; 47(6):1135-1148.
- Rousie C, Van Damme H, Radermecker MA, Reginster P, Tecqmenne C, Limet R.** Spontaneous tracheal rupture: A case report. *Acta Chir Belg.* 2004; 104(2):204-208.
- Zimmerman KL, Moore DV, Smith AS.** Species Specific Hematology, In: Schalm's veterinary hematology, Ed; Weiss DJ, Wardrop KJ, 6th Ed., John Wiley & Sons, Iowa, USA. 2011; pp. 863-864.