

Scientific Report

Generalized subcutaneous emphysema caused by concurrent cricoid cartilage fracture and cricotracheal detachment in a German shepherd dog

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Summary

A dog was presented with history of progressive generalized subcutaneous emphysema and exercise intolerance secondary to dog fight. Radiographic evaluation confirmed extensive subcutaneous emphysema, pneumomediastinum and pneumoretroperitoneum. Surgical exploration revealed cricoid cartilage longitudinal fracture and cricotracheal detachment. The fractured cartilage was sutured and the cricoid cartilage and trachea was approximated using interrupted sutures. Concurrent cricoid cartilage fracture and cricotracheal detachment has not been reported in veterinary literature, which should be considered in any case of subcutaneous emphysema secondary to extrinsic laryngeal trauma.

Key words: Cricoid fracture, Cricotracheal detachment, Subcutaneous emphysema

Introduction

Penetrating injuries of the neck inflicted by animal bites or bullets frequently result in extensive damage to cervical structures. Damage to deep structures includes laryngeal and tracheal perforation, esophageal laceration, nerve and vascular injury, and muscle and skin disruption (Wendell Nelson, 2003). Laryngeal or tracheal lacerations cause subcutaneous emphysema. The subcutaneous emphysema may involve only the peritracheal region or be more extensive and involve the entire subcutaneous area of the body. Such tears may also be responsible for the development of pneumomediastinum and pneumothorax (Wendell Nelson, 2003; Ettinger, 2010). This report describes a case of generalized subcutaneous emphysema in a German shepherd dog due to cricoid cartilage fracture following dog bite.

Case presentation

A 12-year-old female German shepherd sheep dog was presented to Veterinary Hospital with one-month history of progressive subcutaneous emphysema and exercise intolerance. One month before admission the dog had fought with another dog. On presentation, the dog was lethargic and the face and whole body were emphysematous. The scar of dog bite was also noticed on the skin of laryngeal region. On palpation, displacement of laryngeal cartilages from midline was

evident. Cervical and thoracic radiographs were taken and revealed severe subcutaneous emphysema, pneumomediastinum and pneumoretroperitoneum (Figs. 1 and 2). The tear of laryngotracheal junction was also suspicious in cervical radiograph. Endoscopic examination could not find any laryngeal or tracheal perforation, but the appearance of larynx was uneven. Surgical approach to ventral surface of the larynx and neck was planned for exploration and treatment. The dog was premedicated with Acepromazine (0.1 mg/kg IM) and after 30 min anesthesia was induced by combination of Ketamine (5 mg/kg IV) and Diazepam (0.2 mg/kg IV). The dog was intubated and anesthesia was maintained by Halothane (0.8-1%) through oxygen. A ventral cervical midline incision was made from the larynx to the sternum. The paired sternohyoid muscles were separated and retracted along their midline. After thorough exploration of the site, complete longitudinal fracture of cricoid cartilage and cricotracheal detachment was observed. Fractured cartilage was debrided and closed with interrupted preplaced absorbable sutures (2-0 PDS). Then the cricoid cartilage and trachea were approximated using interrupted absorbable sutures that pass through cricoid cartilage and encircled the first two rings of trachea. The larynx and trachea were checked for leakage of air to ensure the tightness of these structures. The area was lavaged and sternohyoid muscles closed using simple continuous pattern. The subcutaneous tissue and skin was closed routinely except for 2 cm that was left open for evacuation of subcutaneous air. Post operative

analgesia was provided by Tramadol (2 mg/kg, IM) and antibiotic therapy (Cefazoline; 22 mg/kg, daily, IM) was considered for 5 days. Dexamethasone was also administered for alleviating post operative laryngeal inflammation and edema. The dog recovered uneventfully. Subcutaneous emphysema disappeared gradually in the 5 days following surgery and the dog returned back to its natural way of life before emphysema. Follow up examination was performed until three months after surgery and the dog was in good physical condition without any clinical signs of laryngeal stenosis.

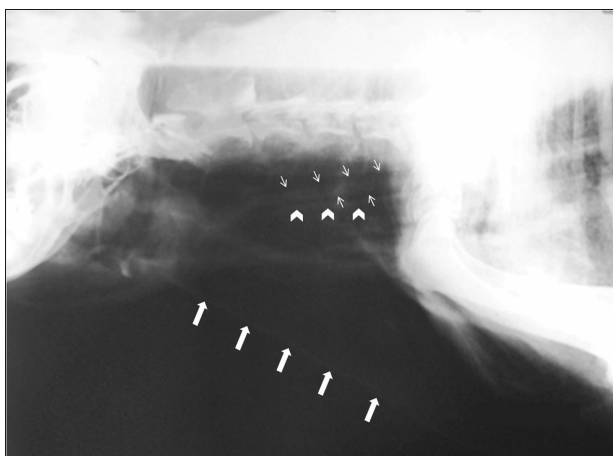


Fig. 1: Lateral cervical radiograph of the dog showing extensive subcutaneous emphysema. The esophagus (small arrows) can be traced as a tubular soft tissue density between dorsal wall of the trachea (arrow heads) and spinal column. Dorsal wall of the trachea in cranial side is indistinct. Body wall in cervical region delineated with big arrows

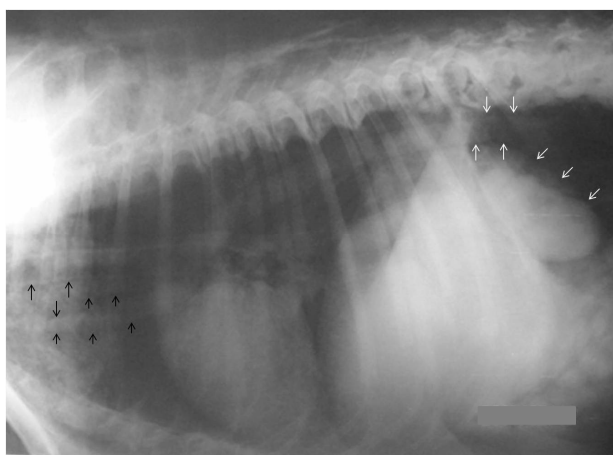


Fig. 2: Lateral thoracic radiograph of the dog showing pneumomediastinum. The mediastinal gas provides increased contrast that increases the conspicuity of mediastinal structures (black arrows). Gas density in the retroperitoneal space increased visualization of kidneys and abdominal aorta (white arrows) indicating accompanying pneumoretroperitoneum

Discussion

Subcutaneous emphysema has been reported in dog, cat, horse, and human because of tracheal perforation.

Generalized subcutaneous emphysema may occur traumatically, iatrogenically, or spontaneously (Caron and Townsend, 1984; Bauer and Currie, 1988; Mitchell *et al.*, 2000; Malliari *et al.*, 2014). In the dog described here, fracture of cricoid cartilage and detachment of cricotracheal junction was diagnosed as cause of subcutaneous emphysema and, to our knowledge, this is the first report of generalized subcutaneous emphysema secondary to this specific cause.

In our case, given the history and scar of dog bite on laryngeal region, traumatic etiology of emphysema was obvious. Choke chain, dog bite, and gunshot injuries account for most extrinsic laryngeal trauma (Manus, 1965). Rupture of the tracheobronchial tree is a common cause of subcutaneous emphysema and should be suspected in any animal with generalized subcutaneous emphysema (Bauer *et al.*, 1988; Hardie *et al.*, 1999). However, in the presented case, there was no evidence of tracheal perforation in exploration. Injury of the larynx was the sole cause of the emphysema. Subcutaneous emphysema has also been reported in veterinary literature following intubation, rhinotomy, transtracheal wash and ventral slot procedure (Bauer and Currie, 1988; Mitchell *et al.*, 2000; Clements *et al.*, 2003).

In the dog reported here, pneumomediastinum and pneumoretroperitoneum were detected in radiography. Pneumomediastinum is characterized radiographically in lateral view by visualization of mediastinal structures that are not normally seen, such as the esophagus and great vessels of cranial mediastinum, because the presence of air within the mediastinum provides excellent contrast to adjacent soft tissue structures. With smaller amounts of mediastinal gas, the changes are less dramatic and the only abnormality may be visualization of the adventitial surface of the trachea (Thrall, 2013). Pneumomediastinum alone is usually not associated with clinical signs. If the pneumomediastinum progresses to pneumothorax, tachypnea and dyspnea are often seen. In our case, there was no clue of pneumothorax in radiography and clinical signs. However, pneumomediastinum progressed to pneumoretroperitoneum because of the communication of mediastinum and retroperitoneum. The presence of subcutaneous emphysema may be uncomfortable for the animal as we saw in this case. The air trapped within the mediastinum does not require treatment and will spontaneously resolve within 2 weeks if there is no ongoing source of air leakage (Biller and Larson, 2010).

In this case after thorough exploration, suturing the fractured cricoid cartilage and cricotracheal junction relieved the animal from subcutaneous emphysema in five days. Furthermore, a part of the skin and subcutaneous tissue was left open to facilitate evacuation of air besides its absorption. Laryngeal stenosis is a complication of laryngeal surgery and other traumas. It is best to prevent laryngeal stenosis by accurate tissue apposition in surgical patients. Laryngeal stenosis secondary to granulation tissue is manifested as progressive dyspnea (Wendell Nelson, 2003). On a three-month follow up, the dog had no clinical signs of

laryngeal stenosis, revealing good alignment of cartilage fragments and mucosa. To the authors' knowledge, this is the first report of generalized subcutaneous emphysema due to concurrent cricoid cartilage fracture and cricotracheal detachment and this cause should be considered in any case of subcutaneous emphysema following severe extrinsic laryngeal trauma.

References

- Bauer, MS and Currie, J** (1988). Generalized subcutaneous emphysema in a dog. *Can. Vet. J.*, 29: 836-837.
- Biller, DS and Larson, MM** (2010). Medistinal disease. In: Ettinger, SJ and Feldman, EC (Eds.), *Text book of veterinary internal medicine*. (7th Edn.), St. Louis, Missouri, Saunders/Elsevier. PP: 1119-1125.
- Caron, J and Townsend, H** (1984). Tracheal perforation and widespread subcutaneous emphysema in a horse. *Can. Vet. J.*, 25: 339-341.
- Clements, DN; McGill, S; Beths, T and Sullivan, M** (2003). Tracheal perforation secondary to suture irritation in a dog following a ventral slot procedure. *J. Small Anim. Pract.*, 44: 313-315.
- Ettinger, SJ** (2010). Diseases of the trachea and upper airways. In: Ettinger, SJ and Feldman, EC (Eds.), *Text book of veterinary internal medicine*. (7th Edn.), St. Louis, Missouri, Saunders/Elsevier. PP: 1066-1088.
- Hardie, E; Spodnick, G; Gilson, S; Benson, J and Hawkins, E** (1999). Tracheal rupture in cats: 16 cases (1983-1998). *J. Am. Vet. Med. Assoc.*, 214: 508-512.
- Malliari, H; Ntasenos, E; Chatziavramidis, A; Printza, A and Konstantinidis, A** (2014). Cricotracheal separation with multiple cricoid fractures after blunt neck injury: a case report. *Hippokratia*. 18: 65-66.
- Manus, A** (1965). Canine epiphyoid fractures. *J. Am. Vet. Med. Assoc.*, 147: 129-132.
- Mitchell, SL; McCarthy, R; Rudloff, E and Pernell, RT** (2000). Tracheal rupture associated with intubation in cats: 20 cases (1996-1998). *J. Am. Vet. Med. Assoc.*, 216: 1592-1595.
- Thrall, DE** (2013). The mediastinum. In: Thrall, DE (Ed.), *Text book of veterinary diagnostic radiology*. (6th Edn.), St. Louis, Missouri, Saunders/Elsevier. PP: 550-571.
- Wendell Nelson, A** (2003). Laryngeal trauma and stenosis. In: Slatter, D (Ed.), *Text book of small animal surgery*. (3rd Edn.), Philadelphia, Saunders. PP: 845-858.