Management of thoracic dog bite wounds

Wounds from dog bites can be more severe than they first seem; what is the best approach to treatment?

Dog bite wounds are regularly encountered in general practice, and the thorax is reported to be one of the most commonly bitten regions. Bites to the thoracic region have been associated with higher mortality rates than bites elsewhere. This is potentially due to the compliance of the canine and feline rib cage and the potential for damage to vital underlying structures. Dog bites can cause a unique combination of injuries in dogs and cats, including damage by crushing, tearing, avulsion and puncture.

The high elasticity of the skin in dogs and cats means that the external wound is not necessarily representative of the degree of underlying injury and the visible wound is often referred to as the “tip of the iceberg” (Figure 1). This is perhaps most significant in smaller dogs and cats, which can be grasped across the thorax by a larger dog. Crushing of the thorax can potentially cause rib fractures, lung lacerations and intercostal muscle avulsion, among other injuries, and these have all been reported in the absence of an externally visible wound (Scheepens et al., 2006).

In addition to the injuries described, dog bite wounds are inoculated with bacteria from the attacking dog’s mouth, as well as contaminants from the patient’s own flora.

**Physical examination**

With the aforementioned concerns in mind, a thorough physical examination should be carried out, with particular attention being paid to respiratory rate, effort and sounds. The thoracic wall should be thoroughly inspected for paradoxical movement, likely representing avulsion of the intercostal musculature (pseudo-flail chest), with potential for concurrent rib fractures.

**Stabilisation**

Patient stabilisation should take priority and may require intravenous fluid therapy, analgesia and oxygen supplementation. Antimicrobial therapy should be started early and the author routinely uses an intravenous, broad-spectrum antibiotic such as amoxycillin-clavulanate or cefuroxime empirically, until culture and sensitivity results are available. If definitive treatment is delayed, a temporary protective dressing can be applied to the wound, to prevent further contamination. Point-of-care ultrasonography can be used to diagnose pleural effusion or pneumothorax, while ensuring minimal stress to the patient. Therapeutic thoracocentesis may be clinically indicated.

**Treatment**

Given the potential for underlying injury and bacterial contamination, surgical exploration of all bite wounds is strongly recommended, in spite of an innocuous looking external wound. This should be performed as soon as patient stability allows. Wound exploration should be performed under...
general anaesthesia in case positive-pressure ventilation becomes necessary. This would occur in cases where the thoracic wall has been disrupted, allowing a communication between the pleural cavity and the subcutaneous space, or even with an external wound. If an open, penetrating wound is present (ie “sucking” chest wound), a closed thoracic cavity must be established using an occlusive dressing. Cellophane film or adhesive waterproof dressings can be wrapped around the thorax to facilitate this. If a closed thoracic cavity cannot be established, emergent anaesthesia (with positive pressure ventilation) and surgery is indicated.

Thoracic radiography is encouraged in all cases of thoracic bite wounds, ideally including inflated right lateral, left lateral and dorsoventral views. If available, computed tomography can be beneficial. Radiographic studies should be carefully evaluated for abnormalities including pneumothorax, pleural effusion, rib fractures, diaphragmatic rupture and lung contusions (Figure 2). Presence of these lesions should alert the clinician to potentially significant underlying injury including intra-thoracic damage. Clinicians should be aware that absence of radiographic abnormalities does not preclude underlying injury.

During clipping, the wound should be temporarily covered with a protective dressing or sterile lubricating gel. A generous area of surrounding skin should also be clipped as extension of the surgical wound or placement of drains may be necessary. Once clipped, the surrounding skin should undergo routine sterile preparation. If used, the protective dressing should then be removed and the wound itself flushed with a copious volume of sterile saline.

When draping, a wide area should be included in the sterile field, again in case an extended incision or drain placement is necessary. It is sometimes possible for small wounds to be excised en bloc within an elliptical incision. When damage is more extensive, the wound can be extended as necessary, ideally along tension lines. Exploration should be continued until the clinician is able to ascertain that injury does not extend further and any devitalised tissue is debrided. Additional injuries should be addressed as necessary.

Additional injuries may include lung lacerations, pseudo-flail chest, rib fracture and significant thoracic wall defects. Lung lacerations are generally managed with lung lobectomy and this can be performed using a stapling device or can be hand-sutured. Current understanding suggests that pseudo-flail chest in itself does not necessitate surgical repair (Olsen et al., 2002). If intercostal muscle damage is encountered during exploration, however, attempts can be made to repair the defect. This may require circumcostal sutures and repair of soft tissues. Similarly, in patients suffering a true flail segment (that is to say fracture of two adjacent ribs, with each rib being fractured in at least two places), a “basket-weave” suture pattern can be used to stabilise the free-floating segment; however, true flail chest is unlikely from bite wounds as it requires an impact trauma, such as may be encountered in a road traffic accident.

**FIGURE (2)** Right lateral (A) and dorsoventral (B) radiographs of thorax of a dog suffering thoracic dog bite wounds. Radiographic abnormalities include subcutaneous emphysema, pneumothorax, collapse of the left lung and fracture of the left fifth and sixth ribs (as well as an incidental gastric foreign body).
In cases where rib fracture results in a de-vascularised section of rib, that segment can be excised. Removal of up to four, or even six, adjacent ribs has been reported to be feasible in dogs, although it is likely to result in a significant thoracic wall defect. Adequate reconstruction of large thoracic wall defects may require recruitment of local muscle flaps, such as the latissimus dorsi, external abdominal oblique, transverse abdominis or part of the diaphragm.

Once definitive treatment has been carried out, the area should be flushed with a copious volume of sterile saline. The author recommends obtaining a swab for culture and sensitivity testing after final flushing. In all wounds, it is prudent to ensure a means of continued drainage, either via open wound management or placement of passive or active-suction drains.

**Post-operative management**

Overall, thoracic bite wounds have a reported mortality rate of 12.5 to 27 percent and post-operative complications have been associated with poorer outcome (Scheepens et al., 2006). Patients requiring thoracotomy have not been shown to have a worse outcome, so owners should not be discouraged from pursuing treatment based on level of surgical intervention required (Scheepens et al., 2006; Cabon et al., 2015; Frykfors von Hekkel and Halfacree, 2019).

Post-operatively, the patient should be closely monitored, particularly for signs of respiratory difficulty, tissue necrosis, wound infection, sepsis and pain. Antibiotic therapy should be continued throughout, based on culture and sensitivity results once available. Drains should typically be removed once drain fluid production has reduced and plateaued, as presence of a drain itself is likely to drive a degree of fluid production. In cases of open wound management, definitive surgery to close the area may be necessary.

**Conclusions**

- Assume a degree of underlying injury, until proven otherwise, and communicate this risk with the owners
- Thoracic radiography can be helpful in assessment of extent of injury
- All wounds should be explored, debrided and flushed and a sample obtained for bacterial culture and sensitivity testing
- Be prepared for more severe injury, including intra-thoracic damage. That means ensuring a wide clip and surgical field as well as being able to provide positive-pressure ventilation if necessary
- Be cognisant of post-operative complications including sepsis or delayed skin necrosis (which can occur several days post-bite) and communicate this risk with the owners

A full reference list is available on request.