

## TREATMENT OF BITE WOUNDS OR SMALLER LACERATIONS

Bite wounds or small skin lacerations that are observed during training runs or a race should be treated initially as indicated in the first section of open wound treatment (debridement, lavage). Specific information on wound closure is provided in the section on this topic below. Frequently, it is sufficient to clean the wound from debris, hair, and blood, suture the wound under sedation or local anesthesia using absorbable monofilament suture material, and initiate antibiotic treatment. The use of skin staplers is discussed controversial among trail veterinarians. While it is a rapid method to close a skin defect, the metal in the skin may become very cold, leading to localized frostbite. It is obvious that this does not support good wound healing, and may lead to pain from the cold metal.

## OPEN WOUND TREATMENT

If a wound cannot be closed, open wound treatment is necessary. It is important to understand that appropriate wound care can only be provided inside. *At temperatures below the freezing point, wet bandage material may freeze and may lead to severe problems.*

Appropriate wound healing requires a clean wound bed. Therefore, if there is any doubt whether a wound is contaminated or not, open wound treatment is indicated prior to closure (Figure 2). Open wound management allows for continued wound drainage, regular wound inspection, lavage and debridement. Sharp debridement under heavy sedation or anesthesia is performed to clean the wound of foreign material and necrotic tissue. Wound lavage is imperative during open wound management and can be performed by either using a syringe system, consisting of an 18g needle and a 60ml syringe, or by using a clean bottle with 18g needle holes in the top (Figure 3). Alternatively, commercial wound lavage systems are available<sup>a</sup>. Ringer's diluted to a 0.05% chlorhexidine solution, is an excellent choice for lavage of open wounds (1# of 2% stock solution and 40# of sterile Lactated Ringer's Solution – don't use Sodium Chloride – chlorhexidine will precipitate in NaCl). Other solutions have been shown to be cytotoxic or to have other negative effects on wound healing.<sup>1</sup> Hydrogen peroxide is contraindicated as wound lavage solution because it kills not only bacteria, but also all reparative cells in the wound, which in turn will delay wound healing.

Traditionally, open wound treatment has been performed using wet-to-dry bandages (Figure 4). These bandages work well and are indicated especially in the early debridement phase, when there is a lot of contamination.



Figure 2: Example of a severe degloving injury on the carpus of a dog. Open wound management is indicated if the leg is to be saved.

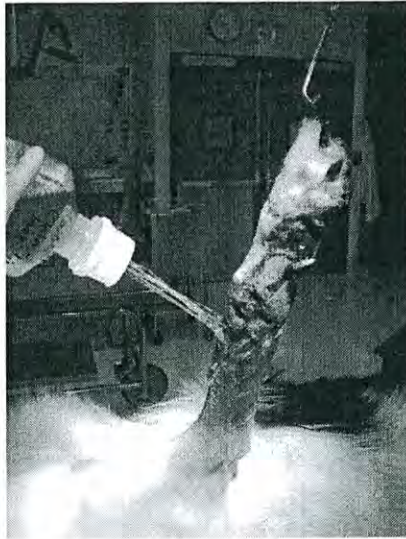


Figure 3: Ringer's diluted to a 0.05% chlorhexidine solution, is an excellent choice for lavage of open wounds.



Figure 4: A wet to dry bandage is applied to a severely contaminated wound.

With moderate amounts of exudates, alginate dressings<sup>b</sup> may be applied. Recent studies in the human field have shown that a warm and moist environment with a pH around 6 decreases multiplication of bacteria and enhances the formation of granulation tissue. Alginate and other dressings provide this environment<sup>b</sup> The absorptive capacity of an alginate dressing is three times that of an equivalent sized gauze sponge. They can be left on the wound for two to three days. Once the exudation decreases, polyurethane foams<sup>b</sup> can be used. They also have larger absorptive capacity than usual sponges and are an effective barrier against bacteria. Finally, once granulation tissue forms, the use of hydrogel dressings<sup>b</sup> is



recommended (Figure 5). They are impervious to bacteria, allow rehydration, debride via autolysis and absorb necrotic tissue. They may be left on the wound for two to three days. In comparison to wet-to-dry bandages, there is minimal pain associated with the removal of hydrogel dressings. Unconventional dressings such as honey, sugar, maggots or leeches are shortly discussed at the end of this paper. An intermediate layer, like cast padding and an outer layer to protect the bandage are necessary to complete the bandage. Do NOT use plastic bags or diapers around the wounds. *The wound needs to breathe*. Once healthy granulation tissue is evident, the wound can be closed.

Occasionally healthy granulation tissue won't form, or the wounds are too big for standard closure. In these situations, wound healing may be facilitated by using vacuum-assisted closure, ultrasound treatment of wounds, different skin flaps, and advanced techniques such as free skin grafts or distant flaps using microvascular anastomosis. To provide the reader with specifics about these fascinating wound treatment methods is beyond the scope of this chapter. Adequate training, experience and appropriate equipment to perform these wound closure techniques are necessary and should be done in a veterinary hospital by surgeons, familiar with these procedures.<sup>2-4</sup>

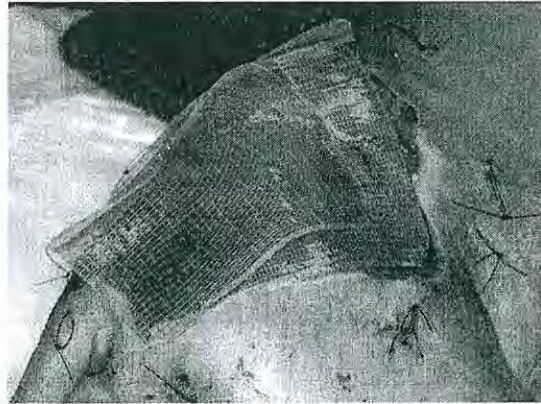


Figure 5: Advanced wound dressings, such as hydrogel, enhance the formation of granulation tissue.

## WOUND CLOSURE<sup>2,3</sup>

The timing of wound closure depends on the amount of contamination and extent of the injury. The four types of wound closure options include: Primary closure, delayed primary closure, secondary closure, and healing by second intention. To avoid dehiscence, it is essential to close all wounds without tension. If necessary, grafting or appropriate flap techniques should be considered. Clean and very fresh wounds may be closed primarily. A commonly used rule of thumb is the "6-hour-rule". A wound that is older than 6 hours should not be closed immediately. Open wound treatment should be performed first. By definition, delayed primary closure is performed before granulation tissue forms, usually after about five days. Delayed primary closure is performed in clean-contaminated wounds, with questionable tissue viability. Open wound treatment and wound lavage for three to five days is commonly necessary. In contrast, contaminated wounds are usually closed after the appearance of granulation tissue (unless a vital structure is exposed, such as esophagus, trachea, nerves, etc). Initial debridement and open wound treatment are necessary, allowing the elimination of exudates and contamination. Secondary closure can be performed at five to seven days. With large skin defects, severe contamination or the appearance of necrotic tissue, a wound may heal by second intention. Granulation, contraction and re-epithelialization help to cover the wound over time. However, the cosmetic result with this type of wound closure may be inferior, and contracture may cause some functional issues. Small wounds and trunk wounds can more often be treated successfully with second intention healing. As with any surgical procedure, it is important to follow Halstead's principles of surgery when closing a wound. Halstead's principles of surgery include: gentle tissue handling, accurate hemostasis, preservation of blood supply, aseptic technique, wound-closure without tension, careful approximation of tissue, and avoidance of dead space.

The placement of "walking sutures" may help to close the wound without any tension at the wound edge. A heavy gauge monofilament suture material is used to place stitches into the granulation tissue and into the skin, pulling the skin towards the wound edge (Figure 6). If you are uncertain about the risk of infection, or if "dead space" is a concern, place a drain. Closed suction drains<sup>c</sup> are preferable over penrose drains in large wounds (Figures 7 and 8). Sled-dogs with drains should be kept in a room to avoid freezing of the exposed tissues or the draining equipment.