Principles of Wound Care & Bandaging Techniques

Jessica Bosco, CVT

Wound care in veterinary medicine is an essential part of patient management with great potential to impact the duration and extent of an animal’s recovery from surgery or traumatic injury.

A wound is defined as a break in the continuity of a tissue of the body. A wound occurs when the integrity of any tissue is compromised (see Anatomy Review, page 62).

Because veterinary technicians are directly involved in patient monitoring and treatment, they play an integral role in the care and treatment of wounds. Understanding the general principles of wounds, wound healing, and various wound care techniques enables technicians to better assess patient progress and promptly recognize and address complications.

WOUND CLASSIFICATION

Classifying wounds and assessing the duration and degree of contamination allows veterinary professionals to determine the appropriate treatment plan for their patients. Wounds are classified as either open or closed.

Open Wounds

- Abrasion: Skin damage with a loss of epidermis and a portion of the dermis
- Avulsion: Tearing of tissue from its attachments
- Incision: Wound created by a sharp tool, resulting in wound edges with minimal tissue trauma
- Laceration: Irregular wound caused by tearing, which produces superficial and underlying tissue damage
Puncture: Penetrating wound caused by a sharp object; punctures cause minimal skin damage but underlying tissue damage may be severe, resulting in a higher risk of subsequent infection by contamination introduced at time of puncture.

Closed Wounds

- Contusion: Blunt-force trauma that doesn’t break the skin but causes damage to the skin and underlying tissue
- Crushing Injury: Force applied to an area of the body over a period of time; commonly seen in bite wounds

Duration & Degree of Contamination

Duration refers to the length of time between the infliction of a wound and wound treatment. Duration and degree of contamination are divided into 3 classes. However, the degree of contamination is more important than the duration; a relatively new wound that has gross debris or devitalized tissue should be assigned a higher wound classification.

- Class 1: Clean wound with minimal contamination and a 0 to 6 H duration
- Class 2: Wound with significant contamination or 6 to 12 H duration
- Class 3: Wound with gross contamination or > 12 H duration

WOUND HEALING

Phases of Wound Healing

There are 3 phases of wound healing; healing can take place on its own or with medical or surgical intervention.

- Phase 1—Inflammatory Phase: This phase occurs immediately after injury and is mainly directed at minimizing blood loss from the injured area by hemostasis—vasoconstriction, platelet aggregation, and clot formation—followed by vasodilation and phagocytosis.
- Phase 2—Proliferative Phase: In this phase, granulation, contraction, and epithelialization of the injured tissues occurs.
- Phase 3—Remodeling Phase: This phase involves formation of new collagen, wound tissue strengthening, and scar formation.

Methods of Wound Healing

- First Intention: Describes primary wound healing or closure; this type of healing is the best choice for healthy wounds in well-vascularized areas.
- Second Intention: Describes secondary wound healing or spontaneous healing. In this process the open wound is allowed to close by epithelialization and contraction (granulation tissue); this process of healing is best for contaminated or infected wounds (Figure 1).
- Secondary Closure: Wound closure > 5 days after injury; granulation tissue and epithelialized skin edges are excised and fresh tissue edges closed.
- Third Intention: Describes tertiary wound healing or delayed primary closure; it is best for infected or unhealthy wounds that are too contaminated for primary closure, but appear clean and well vascularized after approximately 2 to 5 days.
- Epithelialization: Describes healing of partial-thickness wounds, including first-degree burns and abrasions.

TREATMENT OF WOUNDS

How a wound is treated initially and the bandaging technique employed will greatly impact the outcome of a patient’s injury. Poor treatment and bandaging techniques will delay healing, negatively affect patient outcome, and accrue unnecessary charges for the client.

Initial Treatment

The initial treatment of a wound should include:

1. Clipping Around the Wound: A water-soluble gel (ie, K-Y Jelly, jnj.com) is placed in the wound and a large area of skin around the wound is clipped. The gel clumps the clipped hair together and prevents further wound contamination during clipping.

Figure 1. Bite wound of the metatarsal area that was infected and is now closing by second intention.
2. Cleaning Around the Wound: The gel is flushed from the wound with sterile saline (see below) and the skin around the wound is scrubbed with chlorhexidine until debris is removed. Care should be taken to avoid introducing the surgical scrub into the wound as this may cause tissue damage.

3. Cleaning the Wound: Irrigating the wound with adequate volumes of a sterile, balanced electrolyte solution will help decrease bacteria and flush debris from the wound.
   » The wound should be irrigated using a 20-mL syringe and an 18-gauge needle or catheter to provide the appropriate pressure.
   » It is important to remember that higher-pressure irrigation can cause tissue trauma and seed bacteria into the wound.

A decision on closing the wound is then made.
• Wounds that are deemed healthy and can be closed without tension indicate primary closure. One or more gravity or closed suction drains (discussed later in the text) may be required to prevent fluid accumulation in wound dead space.
• If the wound is still considered contaminated or if, when closure is attempted, there is excessive tension on the wound edges, the wound should initially be left “open” and, ideally, bandaged.

Bandaging Technique
Once initial care is completed, the clinician determines the most appropriate type of bandage to apply (see The Benefits of Bandaging). The most common types of bandages are the modified Robert Jones bandage and the tie-over bandage. Tie-over bandages can be used anywhere on the body and are convenient for wounds occurring in areas that would preclude the use of a modified Robert Jones bandage (ie, the head, flank, or inguinal region).

Tie-over bandages (Figure 3, page 64) used for contaminated wounds usually have:

Wound Debridement
All dead and devitalized tissue should be surgically removed from the wound by debridement (Figure 2). This is best performed with a scalpel or sharp scissors under aseptic surgical conditions.
• The wound and surrounding surgical field is draped.
• Debridement is started superficially. While debridement of skin can be somewhat conservative, fat and muscle tissue that does not bleed should be removed.

Figure 2. (A) Bite wound from Figure 1; the clinician is scraping it with a #10 scalpel blade to remove dead tissue and promote granulation tissue formation. (B) Irrigation with 0.9% sodium chloride to flush debris leftover from debridement and decrease bacterial numbers.
1. A **primary/contact layer** of sterile gauze packed into and on the wound
2. A **secondary layer** of sterile laparotomy sponges
3. A **tertiary layer** of waterproof material, which can be a surgical drape or an absorbent pad cut to cover the other layers.

Stay sutures are placed in a circular pattern around the wound and umbilical tape is tied over to secure all of the layers in place.

**Bandage Layers**

All bandages are comprised of a contact layer, secondary layer, and a tertiary layer. The specific material used in each layer is determined by the type of wound and the bandage’s particular function. The frequency of bandage changes depends on bandage type and wound exudate.

**Primary (Contact) Layer**

Primary layers may be adherent, nonadherent, or semi-occlusive.

- **Adherent** bandages include both dry-to-dry and wet-to-dry bandages; they are created with sterile gauze squares. It is important to remember that these sponges debride the wound and their removal may be painful to the patient.
- **Dry-to-dry bandages** are used for wounds producing increased amounts of low-viscosity fluid/exudate and if foreign debris and necrotic tissue are present; for example, wounds that are producing a large volume of noninfected serum-like fluid.
- **Wet-to-dry bandages** are indicated for wounds producing higher viscosity fluid/exudate and if loose debris is present; for example, wounds that are still contaminated after debridement and producing purulent exudate. The gauze sponges are moistened with a sterile, balanced electrolyte solution.

- **Nonadherent** bandages, such as Telfa pads (Kendall Brands, covidien.com), are used to cover a wound for protection but do not provide any additional benefits.
- **Nonadherent, semi-occlusive** bandages can be created using Vaseline-impregnated gauze, which is a material that allows fluid to absorb into the intermediate layer of the bandage. It keeps the wound moist and allows atraumatic removal of the dressing.
- **Other semi-occlusive** bandages can be created using hydrocolloid- and hydrogel-type bandages.
- **Hydrocolloids** form a nonadherent, semi-occlusive gel. The dressings are permeable to oxygen, carbon dioxide, and water and are comprised of a polyurethane layer, colloid matrix, and sterile backing. After wound contact, they become gel-like and form a protective layer.
Hydrogel is a nonadhesive, absorbent polyethylene oxide membrane that covers a gelatinous membrane, which absorbs exudate and keeps the wound moist.

Both hydrocolloids and hydrogel may speed epithelialization on acute, partial-thickness wounds.

Secondary Layer
Secondary layers are comprised of bandage materials that can absorb exudate, secure the contact layer, and provide some pressure to decrease dead space and/or prevent edema. Examples of materials commonly used to create this layer are cast padding and roll cotton (Figure 4).

Tertiary Layer
The purpose of the tertiary layer is primarily to secure other parts of the bandage. Conforming, stretch-gauze bandage (Figure 5) is used. An outer layer (Figure 6) of either Vetrap (3m.com) or Elastikon (jnj.com) is used to secure the 3 layers of the bandage.

Drainage Systems
When there is an abundance of dead space related to the wound or a seroma formation secondary to the wound or surgical intervention, an active or passive draining system is needed for optimal success in wound healing.

Several types of draining systems are currently available in veterinary medicine.

- **Passive drains** do not involve suction but instead simply rely on the pressure differentials between body cavities and the exterior of the body to function.
- **Active drains** are maintained under either low- or high-pressure suction.

Passive Drains
The most common type of passive drain is the Penrose (crbard.com) drain (Figure 7, page 66).

- The Penrose drain is a length of soft rubber tubing that is applied by inserting one end of the tubing into the wound or surgical site; then tunneling the tubing ventrally toward a small skin incision where it exits the body.
- The drain prevents the accumulation of fluid (ie, serosanguinous fluid, blood, purulent material) under the skin.
- The fluid doesn't exit through the tube itself, but rather around the tube, draining at the incision sites.
- The Penrose drain relies solely on gravity to function; there is no collection system associated with it.

Active Drains
Jackson-Pratt (cardinal.com) drains are an active drain with a collection system attached. Although more expensive than passive drains, active drains may decrease the likelihood of an ascending wound infection developing through the drain. They also minimize the need for a bandage to absorb fluid, which is the case with a passive drain.

- This drain pulls excess fluid from the body using constant suction.
- The part of the drain in the wound or body cavity is made of Teflon (dupont.com) and designed with a series of holes or openings that allow appropriate draining.
- The drain is connected to plastic tubing that is sutured to the skin at the insertion site; the exterior end of the tubing is connected to a plastic bulb, which creates negative pressure when squeezed and released, providing suction.

Economical alternatives to the Jackson-Pratt drain can be made; two setups are commonly used:
- Both setups use a 30-inch or longer, sterile macrobore IV extension set that the surgeon alters by

Figure 4. Secondary layer from a bandage made of cast padding.

Figure 5. Tertiary layer of a bandage (conforming stretch gauze).

Figure 6. Outer layer of a bandage (ie, Vetrap, Elastikon).
placing cuts in the tubing to create multiple fenestrations. The sterile line is surgically placed in the body.

- **In the first setup**, a 10- or 20-mL luer-lok syringe is used to generate negative pressure.
  - The syringe is altered by boring a hole through the barrel to allow an 18-gauge needle to pass through the barrel to act as a stopper.
  - The modified syringe is placed on the female end of the extension line; then the syringe is aspirated until it creates constant suction.
  - When the syringe is filled with fluid, it is emptied, the fluid quantified, and the syringe reset.

- **The second setup** involves placing an 18- or 20-gauge needle on the male end of the extension line; then inserting the needle into a vacutainer tube to provide constant suction. When the vacutainer tube fills it is simply removed and a new one inserted.

**Figure 7.** (A) Cervical area bite wounds from a dog that required two passive (Penrose) drains to be surgically placed to allow serous and purulent material drainage and help prevent seroma and abscess formation. (B) The Penrose drains are placed with the openings ventral to allow passive draining.

**PAIN MANAGEMENT GUIDELINES**

In 2007, the American Animal Hospital Association (AAHA) and American Association of Feline Practitioners (AAFP) released the **AAHA/AAFP Pain Management Guidelines for Dogs & Cats**. This article, published in the *Journal of the American Animal Hospital Association* (43:235-248, 2007), not only provides extensive information on the topic, but also includes tables that cover topics, such as frequently overlooked causes of pain and signs of pain, and a pain management algorithm. Read the article at aahanet.org/publicdocuments/painmanagementguidelines.pdf.

**Environment**

Providing a clean, comfortable environment and minimizing stress are important for every patient; those requiring wound care are no exception. In fact, because patients with wounds have a high risk of acquiring infection, the importance of cleanliness cannot be overstated.

- Clean, dry bedding should be provided and the patient should be kept free of urine, fecal material, and other contaminants that promote the proliferation of bacteria.
- Care should be taken when providing water to keep the patient from stepping into or spilling water and soaking its bandage.
- The veterinary technician’s ability to assess patient comfort is an important skill (see **Pain Management Guidelines**). Anxious and/or painful animals may be especially restless. Their increased activity may result in disruption of bandages and drain systems, causing additional trauma and delayed recovery.

**Bandage & Drain Care**

**Bandage Care**

Bandages need to be frequently monitored to identify abnormal swelling of limbs or areas surrounding the bandage. Swelling proximally or distally to the bandage can indicate improper distribution of the bandage material, resulting in tissue damage. Inappropriately placed modified Robert Jones bandages are very likely to cause swelling of the toes, indicating an emergency and immediate notification of the clinician.

**Drain Care**

When monitoring patients with drains the technician should be evaluating the volume and character of the fluid being produced (ie, serous, serosanguinous, purulent) and paying close attention to abrupt changes, such as significant increase in fluid volume or difference in fluid type (ie, serous to hemorrhagic).

**NURSING CARE FOR WOUNDS**

Good nursing care extends beyond the basics of patient monitoring and administering prescribed treatments.
**CONCLUSION**

The proper care of wounds, bandages, and drains is critical to ensuring optimal success in wound healing and restoration of good health. From the initial assessment and treatment of a wound through all stages of its care, the veterinary technician greatly impacts the patient’s recovery through diligent monitoring and careful observation. Knowing the principles of wound care and the various treatment techniques enables the technician to provide the highest level of care, which helps ensure the best outcome for the patient.

---

**PHOTO CREDITS**

**Figures 1, 2, 4–6:** Courtesy Dr. Todd Hamilton, Veterinary Hospital of University of Pennsylvania

**Figure 3:** Courtesy Dr. Georga Karbe, Veterinary Hospital of University of Pennsylvania

**Figure 7:** Courtesy Dr. Meghan Kruse, Veterinary Hospital of University of Pennsylvania

**References**


---

**VACUUMS IN VETERINARY MEDICINE**

Vacuum-assisted closure (VAC; kcianimalhealth.com) is a new modality for veterinary wound therapy. The benefit of the VAC system is its ability to enhance wound healing by:

- Providing even distribution of negative pressure suction
- Drawing wound edges together
- Removing fluid
- Decreasing localized edema as well as bacterial load
- Accelerating debridement
- Promoting perfusion and granulation tissue formation
- Decreasing possibility of tissue trauma or necrosis secondary to localized high-pressure suction.

This system is not required for the majority of wounds but can be beneficial in the initial management of large wounds, infected wounds, or wounds with marginally devitalized tissues after debridement due to its ability to promote increased vascularity.

The VAC system works in the following manner (Figures A and B):

- The wound is prepared by placing a structured, open-cell piece of sterile foam in the wound.
- A suction catheter is placed on top of the foam.
- An adhesive membrane is cut to size and placed over the entire preparation, extending beyond the site and adhering to healthy skin along the perimeter to create a tight seal.
- Continuous suction is applied to the wound using the suction catheter and VAC device (with the desired pressure set).
- Research suggests that 125 mm Hg is the optimal level of negative pressure; therefore, it is the one most commonly used.

**Figures A and B. VAC placement on a patient that was hit by a car, resulting in a large degloving wound on its dorsum**