

Equine Practice on Wound Management

Wound Cleansing and Hygiene



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KEYWORDS

• Equine • Wound management • Wound cleansing and hygiene • Healing

KEY POINTS

- The main goal of wound cleansing and care is the control or removal of tissue infection to allow healing to proceed efficiently.
- What should be kept in mind is that the benefit of a clean wound must be weighed against the trauma inflicted in the process of cleansing.
- Veterinarians and staff need to include the consistent practice of hand hygiene throughout the workday in order to reduce the chances of cross-contamination.

Wound management can be a daily occurrence, with the goals of therapy being restoration of function and an acceptable cosmetic outcome in the shortest amount of time and at the least cost possible. Achieving these goals often depends on control of infection and the reduction of deleterious effects on healing that local sepsis can create. Attempts to avoid infection and optimize wound healing begin at the initial assessment and the chosen approach to wound cleansing. Veterinarians have the potential to have a positive or negative influence, depending on wound cleansing and management as well as attention to personal hygiene. Local infection control and avoiding iatrogenic contamination are essential to good wound management.

A recent review pointed out that the World Health Organization (WHO) considers hand hygiene a pillar of infection control (particularly when related to nosocomial and iatrogenic infections), with a strong focus on their “Clean Hands Save Lives” campaign, which may translate into “Clean Hands Save Horses.”¹ In the nineteenth century, human patient morbidity was substantially reduced with the recognition of germs/microorganisms (sepsis: the presence in tissues of harmful bacteria and their toxins, typically after entry from a wound), the introduction of hand hygiene (asepsis: preventing sepsis/working germ free from the start) and antiseptic principles (combating sepsis). Essentially, in the mid 1800s, it became clear that instead of just treating infections, the focus should be on prevention.

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Skin has a balanced ecosystem of resident microbes, generally not pathogenic on intact skin, and transient microbes that are present via contact with patients, staff, and environmental surfaces. Resident microbes compete for nutrients with transient microbes, which are the most common cause of health care–associated infections (HAIs). Maintaining a positive balance to reduce transmission of pathogenic bacteria through hand hygiene is as important as is maintaining the natural skin environment and barrier. This task can be more difficult when working with equine patients because the environment can be rough on hands, leading to damage and irritation. Frequent contact with infected wounds and dirty environments creates a need for frequent hand washing. However, repeated hand washing can compromise skin integrity, lead to contact irritant dermatitis, and potentiate colonization with pathogenic microbes. Balance of hygiene and skin health is important.

- HAIs are often transferred from the hands of health care personnel to their patients.
 - Catheter site infections
 - Respiratory and urinary tract infections
 - Wound infections (inspections and bandage changes)
 - Hand hygiene is a simple and effective way to reduce HAIs
- The WHO guidelines (adapted by Verwilghen in 2016) on hand hygiene recommend 5 moments when caring for patients²:
 1. Before touching the patient
 2. Before a clean/aseptic procedure
 3. After body fluid exposure risk
 4. After touching the patient
 5. After touching patient surroundings
- Ways to support healthy skin
 1. Wash hands with a mild detergent soap when organic matter needs to be removed.
 2. Do not scrub hands in a manner that irritates skin.
 3. Use alcohol sanitizers for most hand cleaning, preferably with moisturizing ingredients.
 4. Use hand moisturizing lotion throughout the day to help protect skin barrier status.

WHAT IS THE RIGHT WAY TO WASH YOUR HANDS?

From the Centers for Disease Control and Prevention Web site: follow the 5 steps below to wash hands the right way every time³:

- *Wet* hands with clean, running water (warm or cold), turn off the tap, and apply soap.
- *Lather* hands by rubbing them together with the soap. Be sure to lather the backs of hands, between your fingers, and under your nails.
- *Rub* hands for at least 20 seconds.
- *Rinse* hands well under clean, running water.
- *Dry* hands using a clean towel or air dry them.

WHAT SHOULD YOU DO IF YOU DO NOT HAVE SOAP AND CLEAN, RUNNING WATER?

Washing hands with soap and water is the best way to get rid of microorganisms. If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60% alcohol. The product label can verify that the sanitizer contains at least 60%

alcohol. Alcohol-based hand sanitizers can quickly reduce the number of microorganisms on hands in some situations, but sanitizers do *NOT* get rid of all types of microorganisms. Hand sanitizers may not be as effective when hands are visibly dirty or greasy.

HOW DO YOU USE HAND SANITIZERS?

- Apply the gel to the palm of one hand (read the label to learn the correct amount).
- Rub hands together.
- Rub the gel over all surfaces of hands and fingers until hands are dry. This should take around 20 seconds.

Despite the benefits of hand hygiene against HAIs, including surgical site infections, septic processes in wounds remain a serious problem in human and veterinary medicine. In addition, there is the danger of zoonotic infections, including infection with methicillin-resistant *Staphylococcus aureus*, which can be a substantial concern between horses and humans.

WHAT IS THE PROPER WAY TO ENCOURAGE AND PRACTICE HAND HYGIENE?

- Recognize that skin health and integrity are important, so decontamination methods and products that are the least harmful to the skin are key.
 - Aggressive brushing or harsh disinfecting soaps are not indicated.
 - Sanitizing products with conditioners and emollients to support skin health are recommended.
 - Frequent application of skin care creams and lotions is recommended.
- When hands are visibly soiled with body fluids or other organic material, they should be washed with a gentle pH neutral nonmedicated soap.
- When not visibly soiled, an alcohol-based hand sanitizer should be used.
 - A product with 60% or greater ethyl alcohol should be used.
 - Ideally the product chosen would also contain hand conditioners, such as aloe and vitamin E.
- Compliance will be enhanced by ensuring the following:
 - Product accessibility, including soap, disposable towels, alcohol sanitizer, examination gloves, and skin care lotions.
 - Dispensers should be at several locations:
 - Sinks and other wash stations (**Fig. 1**)
 - Entrances to examination rooms, barn aisles, and stalls
 - On medicine and bandage carts
 - Staff education
 - Frequent reminders and examples
 - Handouts and posters

WOUND CLEANSING

Wound healing typically follows 3 phases: acute inflammation, repair (or proliferation), and maturation. When the acute response is too great or prolonged, transition into the repair phase can be delayed. The greatest ability to influence healing after wounding likely involves the acute inflammatory phase and initial wound management. Factors that influence the inflammatory response include the following:

- Severity and type of injury (such as sharp vs blunt trauma)
- Foreign material and devitalized tissue
- Infection



Fig. 1. Hand cleansing products: soap, alcohol sanitizer, and clean towels, should be readily accessible.

All open wounds contain bacteria, and potentially other microorganisms, that come from the environment or the horse. These bacteria can be contaminants (not replicating in the wound) of limited consequence; they can colonize (replicating but not causing trauma), or they can cause infection. Wound infection is established when enough microorganisms are present in a wound to cause host-tissue injury, generally accepted as when the number is greater than 10^6 bacteria per gram of tissue. The type of injury/wound sustained and the systemic condition of the horse influence the presence of a local septic process. Other factors that favor wound infection are as follows:

- Contamination with feces, which can contain 10^{11} bacteria per gram
- Contamination with soil, which can contain infection potentiating factors from organic or clay components
 - Infection can appear with as little as 100 microorganisms per gram
- The virulence of offending bacteria
- Reduced local defense mechanisms due to damaged blood supply, foreign body presence, or necrotic tissue

Initial wound cleansing can help reduce these adverse influences. “First do no harm” is an appropriate guiding principle. Attention to wound environment and veterinary hygiene is important. Good personal hygiene is especially important in challenging environments, such as paddocks, stalls, and barn aisles, and even hospitals with potential nosocomial pathogens and iatrogenic contamination.

SUGGESTED PREPARATIONS FOR INITIAL WOUND MANAGEMENT, AVOIDING FURTHER/CROSS-CONTAMINATION

- Use a clean, manageable work site with minimal disruptive traffic.
- Set up a clean area. Supplies can be securely placed on a portable table (**Fig. 2**).
- All commonly used supplies should be readily available.
- Grooming tools can be used to clean debris off the horse and the region of the wound.
 - A temporary bandage can cover a wound while brushing hair and debris from the surrounding area (**Fig. 3**).
- Wash hands and then use a hand sanitizer before donning examination gloves.
 - If soap and water are not available, an alcohol-based hand sanitizer (>60% ethyl alcohol) can be used alone.



Fig. 2. Supplies can be kept clean and organized on a portable table.

- Clip hair from a large area starting at the edges of the wound and move outward a few inches in all directions (**Fig. 4**).
 - Clipper blades should be sharp and clean (disinfect between patients).
 - Wetting hair around the wound with water can reduce the potential for hair to fall into the wound while clipping.
 - Sterile, water-based lubricating gel can be placed into the wound OR gel-soaked gauze sponges can also be placed into the wound. These methods also retard entry of hair and debris into a wound.
- Sanitize hands again and don fresh gloves before proceeding to further address the wound.

CLEANSE THE WOUND

It is impossible to completely eliminate bacteria from a wound. The goal of cleansing is to reduce the volume of necrotic debris and bacterial numbers. It is important to realize that any form of cleaning, mechanical (scrubbing with gauze) or chemical (antiseptic agents), will involve some level of debridement to remove contamination and devitalized tissue. In some cases, the physical damage and cytotoxicity are more traumatic to the wound than they may be beneficial. Therefore, the form and force of cleaning should be balanced between the desired effect and potential for harm to the tissue.

SCRUBBING/PHYSICAL CLEANSING

- In the past, “scrubbing” the wound was the most common form of physical debridement used and is one of the most effective and rapid means of reducing



Fig. 3. A temporary bandage in place to cover and protect the wound while the rest of the limb is brushed off.

the bacterial load in a wound. However, physical scrubbing is nonselective and may delay wound healing by damaging normal tissue. Generally, scrubbing should be limited to the intact skin around the wound, and any application of force to wounded tissue should be limited to the least amount possible to achieve wound decontamination (**Fig. 5**). A study on intact skin of horses compared 5 minutes of mechanical scrubbing with gauze sponges and 4% chlorhexidine gluconate detergent (CH) to a second group where CH and sponges were used for 15 seconds to attain a lather, which was left for just more than 4 minutes skin contact time. The reduced mechanical scrubbing technique was as effective in reducing bacterial numbers on the skin as the traditional 5-minute scrub.⁴

- Usually performed by “scrubbing” with gauze (woven gauze is more abrasive than nonwoven).
- Recognize that desired superficial fibroblasts and epithelial cells will be removed along with deleterious contamination.
- Use the least amount of force and least abrasive technique possible to remove soil, feces, devitalized tissue, and other contaminants.
- Use of the sponge portion (not the bristles) of a surgical scrub brush, especially when moistened, can be used as a lower friction cleaning tool.
- The scrubbed area can be rinsed with sponges soaked in sterile saline or with 70% isopropyl alcohol (intact skin only). Larger areas can be rinsed by



Fig. 4. Clip hair around the wound in a perimeter large enough to allow proper cleansing. The surrounding hair can be wetted, and sterile gel can be placed in the wound to reduce the entry of hair and debris into the wound.

puncturing 3 to 4 holes in the top of a 1-L bottle of saline with a 14-gauge needle (**Fig. 6A**) and using it as a squeeze bottle (**Fig. 6B**).

ANTISEPTICS

- Antiseptic agents have been used for skin preparation, wound cleaning, and lavage. Although topical antiseptics will reduce the bacterial load in wounded tissue, they are nonselectively cytotoxic and will damage all cell types on contact. Because of their cellular toxicity their use, and that of isopropyl alcohol, is best limited to intact tissue around a wound.⁵
 - Povidone iodine (PI) has a broad spectrum of activity against gram-positive and gram-negative bacteria and fungi. Its use is best limited to intact peri-wound tissues.
 - CH has a broad antimicrobial spectrum of activity that has a residual effect due to its binding to the stratum corneum of skin. CH is contraindicated around the cornea and open synovial structures, and use is best limited to intact peri-wound tissues.
 - Prior studies in humans and animals have not found clear evidence to favor one antiseptic over another, what seems to be generally agreed upon is to avoid open wound contact with antiseptics or alcohol.



Fig. 5. Scrubbing and the use of antiseptics should be limited to the intact periwound tissue.

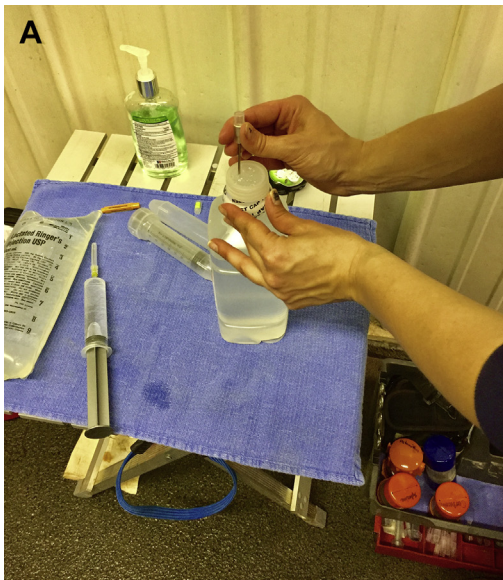


Fig. 6. (A) A needle can be used to puncture the top of a bottle of saline for rinsing of larger areas. (B) Using a squeeze bottle of saline for rinsing.

- Hydrogen peroxide, acetic acid (distilled vinegar), and Dakin solution (0.5% solution of sodium hypochlorite/bleach) are other occasionally mentioned antiseptics; the balance between the positive and negative effects of their use may be more difficult to determine, and so their use is left to the careful discrimination of the operator.

WOUND LAVAGE

- Hydrotherapy can be effective in reducing contamination of a wound while being less damaging than scrubbing and antiseptics to normal tissue. Irrigation should be the mainstay of wound-cleansing techniques.
 - In a fresh wound (<3 hours old, minimal inflammatory response), adequate cleaning can be accomplished with just water or a sterile isotonic fluid like normal saline (0.9% NaCl) or lactated Ringer solution (LRS). Wounds of longer duration, in which bacteria become more established, will most likely require some level of careful debridement.
 - Irrigation technique
 - To overcome the adherence of bacteria to a wound while avoiding tissue damage or driving bacteria deeper into tissues, the fluid should be delivered at a pressure of 8 to 15 psi.⁶ The stream should be at an oblique angle to the surface of the wound (Fig. 7).
 - Approximately 15 psi pressure can be achieved using a 35-mL syringe and a 19-gauge needle.⁷
 - Commercial irrigation systems are available, such as the Interpulse System (Stryker, Kalamazoo, MI, USA) and the Sidekick Water Flosser (Waterpik, Inc, Fort Collins, CO, USA).
 - Irrigation fluid selection
 - Isotonic fluids, such as normal saline or LRS, will provide an irrigation medium that is least harmful to the wounded tissue.
 - If greater volumes are needed for larger or multiple wounds, tap water can be initially used to produce “homemade saline.”
 - Saline solution can be made by adding 8 teaspoons of salt to 1 gallon of boiled water (or 2 teaspoons [10 mL] of salt per liter) and then cooled.
 - For larger irrigation volumes, a 1-gallon “garden sprayer” can be used (purchased for dedicated wound use). To gauge proper pressure, approximate the feel of the stream from a home shower and maintain a distance of at least 6 inches from the sprayer tip to the wound (Fig. 8).
 - Although there are no guidelines to govern total volume of irrigation fluid, an amount that removes visible debris and contamination without causing the tissue to become swollen or blanched (waterlogged) is recommended.
 - Although cleansing an acute wound is often safely accomplished using saline or LRS, chronic or heavily contaminated wounds may benefit from the addition of an antiseptic (to a diluted level) in an effort to reduce the expected bacterial load of the wound. Debate, regarding what additives to use, continues as results of conflicting studies (in vitro vs in vivo findings) can be difficult to interpret and put to clinical use for the horse.
 - Use of antiseptics like PI and CH in diluted form will allow a balance between antimicrobial action and tissue cytotoxicity.⁵
 - PI 10% solution can be diluted to a concentration of 0.1% by adding 10 mL per liter of irrigation fluid.
 - CH 2% solution can be diluted to a concentration of 0.05% by adding 25 mL per 975 mL of irrigation fluid.



Fig. 7. A syringe and needle can be used to apply irrigation cleansing and gentle debridement to the wound.

- Use of antibiotics as additives to lavage fluid should be discouraged or only approached with due caution regarding concerns of developing bacterial resistance.

REPEATED WOUND CLEANSING

Serial wound cleansing may be needed in heavily contaminated wounds and those healing by second intention to remove substances deleterious to the healing process, such as organic debris, exudate, and necrotic tissue.

- Approach each repeat wound examination and cleansing session with the same care as the initial examination. The balance between the force of cleaning and materials used to benefit the healing wound, against the potential deleterious effects on the tissue and propagating cells (epithelial cells and fibroblasts), becomes very important in making decisions.
 - Practice proper hand hygiene.
 - Clean off gross debris from the horse.
 - Repeat hand hygiene.
 - Remove the bandage and visually inspect the wound.
 - Repeat hand hygiene and don gloves.
 - Address the wound as needed.

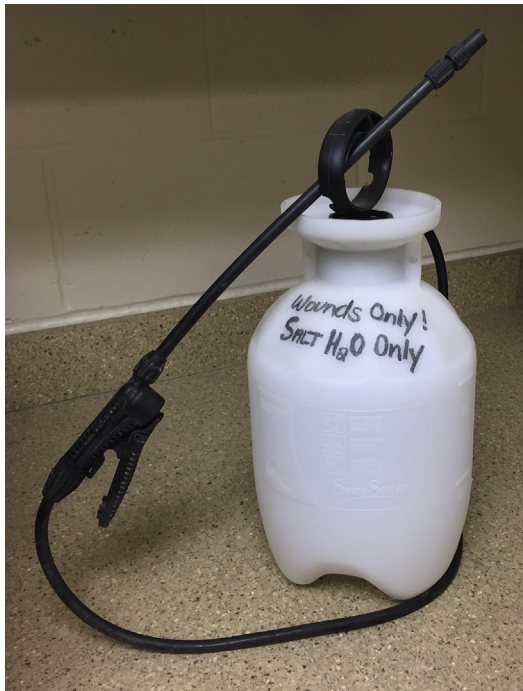


Fig. 8. For very large wounds or multiple wounds that require large volumes of irrigation fluid, a garden sprayer can be purchased and dedicated for wound lavage.

- Repeat hand hygiene.
- Reapply dressing and a bandage if indicated.
- Repeat hand hygiene.

The main goal of wound cleansing and care is the control or removal of tissue infection to allow healing to proceed in the most functional, cosmetic, fastest, and least expensive manner possible. These attempts at decontamination are accomplished through the removal of debris and necrotic tissue while reducing the bacterial load via careful use of mechanical techniques and cleaning agents, accepting that some level of tissue trauma will result. What must always be kept in mind is that the benefit of a clean wound must be weighed against the trauma inflicted in the process of cleansing. In addition, it must be realized that veterinarians and staff need to include the consistent practice of hand hygiene throughout the workday in order to reduce the chances of cross-contamination to equine patients and also transfer of zoonotic pathogens to humans. Veterinary health care professionals should constantly be taking steps to reduce the incidence of hospital-acquired infections and zoonotic disease transmission. Although the condition in which patients are presented cannot be controlled, human impact, negative and otherwise, on the patient's health can be controlled.

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