Wound Care & Management

EQS 110
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Wounds 101

A wound is defined as an injury to living tissue caused by an act that results in the skin being cut or broken. Remember back to our lecture on the integumentary system; one of the functions of the integument is environmental protection. If a wound occurs, the horse is now susceptible to an infection due to this first line of defense being penetrated!

An injury that results in a wound is not an issue of if, but when; one of the most common reasons why a veterinarian is called is due to trauma that results in skin and soft tissue wounds. While wounds can happen on any area of the horse’s body, most wounds occur on the limbs and are caused by foreign objects, such as fences, gates, and farm implements.

Anyone responsible for the care and well-being of a horse should be well-versed in the proper care and treatment of wounds.

What Can Be Injured?

Many people think a wound only involves the skin, but depending on the location and severity of an injury there can be other complications.

Vasculature

Vasculature refers to the circulatory means in the body (veins, arteries, capillaries). Injury to vasculature that supports large amounts of blood flow can result in severe, uncontrollable bleeding known as hemorrhaging. By knowing our characteristics of the venous and arterial vasculature, we can quickly determine which one has been impacted by an injury. An arterial hemorrhage is going to result in a high flow rate of bright red blood spurting, jumping or pulsating out of a wound while a venous hemorrhage has a slower flow rate of dark red blood. While arterial hemorrhaging is deemed more serious than venous, keep in mind that not all injuries are not externally visible – internal bleeding can also occur.
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Nerves

Injuries to nerves can result in a loss of sensation that may or may not return over time. Depending on the severity of the injury and nerves impacted, the horse may have a full loss of limb function that can be life-threatening.

This horse is unable to bring the left front leg forward due to a paralysis of the radial nerve.

Tendons and Ligaments

Wounds involving tendons and/or ligaments can be performance and life-threatening. On top of this, healing can be a long and difficult process.

Synovial Structures

Many synovial structures are superficial and easily penetrated, putting them at a higher risk for injury. This is of great concern because contamination of a joint can be life-threatening as infection is difficult to treat.
Types of Wounds

There are six main types of wounds:

- Contusions
- Incisions
- Punctures
- Abrasions
- Lacerations
- Burns

The force, trauma, or injury sustained will determine the type of wound created.

Contusions

A contusion is a bruise (bleeding) under the skin due to blunt force trauma. This trauma causes tears in muscle fibers and vessels but does not result in the skin breaking. Horses often get contusions if kicked by another horse. Typically, small contusions can be managed with cold hosing multiple times a day but larger contusions may need to be drained to prevent or eliminate a possible infection.

Abrasions

An abrasion also referred to as a “scrape”, is a non-penetrating superficial wound of the skin typically involving a loss of hair. This type of wound often involves minimal treatment – gentle cleaning of the affected area and keeping it free of contamination is the primary course of action. Depending on the severity of the abrasion, the hair that returns during healing may be white due to hair follicle damage.

Incisions

Incisions are a slicing type of wound that has smooth and clean edges and goes the full depth of the skin. Once thoroughly cleaned, incisions often require suturing, stapling, or gluing.
Lacerations

A laceration is a wound that is longer than it is deep, leaves jagged edges of skin, and may have underlying soft tissue damage. These types of wounds are at greater risk for infection and may require debridement, which is the removal of damaged tissue.

The photo to the right illustrates a type of laceration known as degloving, which is a laceration that removes a large amount of skin around the lower leg.

Punctures

A puncture wound is a penetrating wound that is deeper than it is wide. It is very important when dealing with a puncture wound that it heals from the inside out – if skin heals over the wound first it can conceal bacteria in the wound and create an infection that will inhibit healing.

Burns

A burn results in a break of the skin surface which can cause various degrees of tissue damage. Burn wounds are not just caused by fire/heat but also chemicals, electricity, and freezing. The severity of a burn is graded on a scale from 1 – 3, with first degree burns affecting the outer epidermis while third degree burns impact both the epidermis and dermis layers as well as nerve endings and blood vessels. A horse with more than 20% of his body in third degree burns has a poor prognosis for survival.
Wound Examination

In order to determine the best course of healing and treatment, we must examine wounds based on four criteria: type of wound, location, age, and contamination. Since we have already discussed the six main types of wounds, we will focus on the latter three.

All of these considerations will assist us in planning the most appropriate treatment protocol that will encourage healing.

Location

The location of a wound affects several factors that are critical to rapid, efficient healing. In the following chart, we look at some key considerations when dealing with the location of a wound.

<table>
<thead>
<tr>
<th>Contamination</th>
<th>Wounds located distally on the body and near the anus or sheath are more likely to become contaminated – a cleaner, less infected wound will heal more quickly!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Supply</td>
<td>Locations that have adequate blood supply will have faster healing than those that do not</td>
</tr>
<tr>
<td>Motion</td>
<td>Motion impacts the pulling together of the skin edges during healing – high motion areas, such as joints, are prone to recurrent wound opening</td>
</tr>
<tr>
<td>Ease/Safety/Practicality</td>
<td>Certain locations are going to be more difficult to deal with than others – wounds on the hind limbs can be dangerous to treat while wounds on the shoulder, head, neck, knee, and hock can be challenging to bandage</td>
</tr>
</tbody>
</table>

Age

The sooner a wound is identified and treated, the better the prognosis is for recovery. The longer it takes to identify or treat a wound, the greater the risk of infection, which can slow the healing process. We can often tell the age of a wound by its physical characteristics. Acute (sudden, recent) wounds are typically oozing blood, have no presence of pus discharge or odor, and little to no surrounding swelling. Chronic (older) wounds will show a dark red-brown-black appearance due to the blood drying, dried or scabby flesh, thick pus discharge, hot and painful swelling, and a possible fever due to an infection setting in.
Contamination

Remember that tissue contamination of a wound occurs at the time of injury and until the wound is treated. As discussed earlier, certain wound types and locations will hold or gather tissue contamination and damage worse than others.
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Wound Healing

The key components of our wound examination – type, location, age, and contamination – will dictate the best type of wound healing. Wounds have the ability to heal three different ways:

- **1st Intention / Primary Surgical Closure**
- **Secondary Surgical Closure**
- **2nd Intention Healing**

We will look at each of these three types in further detail to see what type of wound healing would be most appropriate for specific situations.

Types of Wound Healing

**1st Intention / Primary Surgical Closure**

*1st intention healing*, also called primary surgical closure, is healing that involves the use of suture, skin staples, or gluing. This type of healing is done immediately after discovery and once the wound is cleaned. Wounds that are fresh (less than 6 – 12 hours old), are minimally contaminated, and have a good blood supply do well with primary surgical closure. Wounds that are old, contaminated, or have a high amount of tissue damage should not be closed by primary surgical means.

**Secondary Surgical Closure**

*Secondary surgical closure* is similar to primary but instead of closing a wound immediately we wait 2 – 5 days after the injury. This gives the wound a chance to be cleaned and checked for infection. Wounds that may need extra time to be cleaned and cleared of infection can benefit from secondary surgical closure.
2\textsuperscript{nd} Intention Healing

2\textsuperscript{nd} Intention healing involves healing by natural means – we are letting the wound fill in the void space itself. While it is the slowest form of healing and produces the least cosmetic result, it is necessary for older wounds and cases where suturing isn’t possible. Many minor wounds that we deal with on a frequent basis are often healed by 2\textsuperscript{nd} intention.

Due to this wound being close to a joint, 2\textsuperscript{nd} intention healing is recommended since a high degree of motion can cause sutures, staples, or glue to break.

Stages of Wound Healing

There are four phases to the healing process: inflammatory, debridement, repair, and maturation. Each phase must be completed before the injury is healed. Therefore, recovery time is the combined duration of all four stages. If one stage is prolonged, healing is delayed or discontinued completely. Any treatments we apply during the healing phases should shorten the phase, not prolong it.

Inflammation

The inflammatory stage begins the healing as soon as the injury occurs and lasts for 6 hours post-injury. During this time, bleeding is slowed while cells associated with clean-up and healing work on the site. Controlling inflammation is important because a long duration of inflammation can impede the healing process – use of cold therapy, such as cold hosing and flushing the wound will be key.

Debridement

Debridement involves pus, a substance exuded from a wound that contains waste products but also healing components, such as white blood cells and serum. Many people think pus needs to be frequently cleaned off a wound but this substance is actually a sign that healing is occurring – wiping it off and drying up the wound can actually impede healing because cells need moisture to move around and work. This phase of healing will last until all the injured tissue and infection is cleared.
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Repair

During the repair phase, the wound is filled in with granulation tissue, a highly vascular tissue that helps pull the wound together. Eventually, this tissue will be covered with new skin. The repair phase of healing often goes unnoticed because it is hidden under a scab if the wound was not surgically closed.

Maturation

Maturation is the final phase of healing in which new tissue, including scar tissue, is organized and strengthened.

Healing Awry – Proud Flesh

Sometimes the healing process is not a smooth journey due to the type of wound or man-made error during healing. One of the most common wound healing issues is proud flesh. Proud flesh is an exuberant amount of granulation tissue that is caused by delayed healing. A delay in healing allows the granulation tissue to grow faster than the skin margins (edges) closing and this tissue will continue to increase until it is either surgically or chemically removed.

A few reasons why a delay in healing would occur include:

- Frequent bandage changes that remove new skin cells
- Excessive heat or cold therapies
- Physically irritation – too much cleaning! Chronic irritation or inflammation

To combat proud flesh, we must either surgically remove it or chemically treat it. A surgical approach known as debriding will remove the granulation tissue to the level of the skin while a chemical approach is going to use a caustic substance to eat away at the tissue. One product that is used in chemical removal is Wonder Dust. While this product can effectively treat proud flesh it also can kill healthy cells and further slow the healing process.
Wound Cleaning

The 1st step in treating a wound is to remain calm. When discovering a wound, always assess the overall condition of the horse as well as your safety and the horses’. If needed contact your veterinarian, but other steps that can be taken may include controlling bleeding through applied pressure and gently cleaning the wound to thoroughly evaluate the area.

Step 1 - Lavage

When cleaning a wound, the 1st step is to lavage, the use of slightly pressured fluid to flush a wound. There are appropriate solutions that should be used to lavage as the wrong fluid may irritate the tissue:

- **Sterile lactated ringers** = sterile water + electrolytes
- **Saline solution** = salt + distilled water

Water from a hose (tap water) is good to use on initial debris, but not for flushing as it can slow healing.

A lavage is best done with a syringe (with or without a needle) so the fluid can be directed precisely into the affected area. Be careful with the amount of pressure you use – too much pressure can damage the tissue.

Step 2 - Clean

Once the initial lavage has been performed we are going to lavage again, but this time with a cleaning solution. Using the correct cleaning solution is critical as many commonly used solutions can cause more harm than good. Hydrogen Peroxide, Bleach, and Rubbing Alcohol are three solutions that **should not** be used to clean a wound as they will irritate, burn, and damage vessels and cells! The best solutions to clean a wound with are diluted betadine or chlorhexidine.
Step 3 – Dress & Bandage

A *dressing* is a single-use covering that is designed to be placed over a wound. Depending on the type and severity of the wound, we may or may not be able to dress and/or bandage the wound. For example, puncture wounds are best healed through lavage and cleaning, and then left open to encourage drainage. Dressing is also going to involve bandaging, so if the wound is on an area of the body that is unable to be bandage, then the best treatment approach is to perform regular lavaging, cleaning, and maintaining the horse in a sanitary environment.

Commonly used dressings include non-adherent (Telfa) pads and 4” x 4” gauze. Telfa pads allow for a small amount of fluid to move from the wound to the dressing and is best used with 1st intention healing and wounds in the inflammation or repair stage. 4” x 4” gauze pads help remove dying tissue and debris with each bandage change so they are best for wounds in the debridement stage. Other types of dressings might be considered depending on your wound situation; work with your veterinarian on what the best course of action would be for your particular circumstance.

Once an appropriate dressing has been picked, the wound will need to be bandaged. Bandage not only helps keep the area clean but can also help control hemorrhaging. Correct bandaging is important because improper bandaging can result in further damage. Wound bandages should provide sufficient padding and provide even pressure. Unlike our common stable or exercise bandages, wound bandages are going to consist of three to four layers:

<table>
<thead>
<tr>
<th>Layer</th>
<th>Purpose</th>
<th>Materials</th>
<th>Notes</th>
</tr>
</thead>
</table>
| 1st Layer | Makes direct contact with the wound | Dressings:  
- Telfa  
- 4” x 4” gauze pads | May be held in place by thin, elastic, cotton wrap |
| 2nd Layer | Provides padding and support, absorbs fluid, immobilizes as needed | Roll cotton  
- Cotton combine  
- Quilt/Pillow Padding  
- Sheet Cotton | |
| 3rd Layer | Used to hold the other layers in place, apply pressure, and protect the first two layers from the environment | Elastic bandage/wrap:  
- Vetrap | |
| 4th Layer | May be needed to provide additional stiffness, pressure, and durability | Elastic/Adhesive:  
- Elasticon | |
What About Ointments?

You might have noticed that while discussing wound cleaning and dressing topical ointments were not mentioned. Topical wound products need to be used with discretion and care – while you may have good intent, over application or choosing the incorrect product can delay or worsen wound healing. For example, wounds that are going to be sutured should not have any ointments applied prior!

If you want to be stocked with a wound ointment, topical ointments labeled as **hydrogels** are best for the initial healing stages because they are water-based. As a water-based ointment, healthy cells can still move around and get the job done in regards to cleaning; applying a heavy, thick creamy ointment can actually suffocate cells, leading to delayed healing. Ointments that are **lanolin** based are better for the maturation stage of healing because they keep the new skin soft and pliable.

The following is a list of common equine wound products and their use:

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vetericyn</td>
<td>A hydrogel with anti-bacterial and anti-fungal properties – best used on the initial/early stages of wound healing</td>
</tr>
<tr>
<td>Fura-Zone</td>
<td>Oil based anti-bacterial product, due to its thickness it may slow healing when used in the early stages</td>
</tr>
<tr>
<td>Biozide</td>
<td>A hydrogel with bactericidal and fungicidal properties</td>
</tr>
<tr>
<td>Corona</td>
<td>A lanolin based cream that helps new tissue remain pliable – best used in the maturation stage of healing</td>
</tr>
<tr>
<td>Triple Antibiotic Ointment</td>
<td>Effective and safe to use on a variety of wounds</td>
</tr>
<tr>
<td>Silver Sulfadiazine</td>
<td>Good for burns, fungus, and has anti-bacterial properties</td>
</tr>
</tbody>
</table>
Self-Knowledge Checks

1. _____ from a wound would be deemed a more serious situation.
   a. Venous hemorrhaging
   b. Arterial hemorrhaging

2. A non-penetrating superficial wound that typically involves a loss of hair would be called:
   a. A contusion
   b. A laceration
   c. An abrasion
   d. A burn

3. A puncture wound must heal:
   a. From the outside first
   b. From the inside first

4. The sooner a wound is identified and treated, the better the prognosis for recovery
   a. True
   b. False

5. The use of sutures, skin staples, or gluing during healing is defined as:
   a. 2nd Intention Healing
   b. 1st Intention Healing
   c. Secondary Surgical Closure

6. What is the first stage of wound healing?
   a. Repair
   b. Debridment
   c. Inflammation
   d. Maturation

7. A wound that fills with too much granulation tissue due to delayed healing has:
   a. Proud Flesh
   b. Dew Poisoning
   c. Maturation
   d. Blistering

8. When cleaning a wound, what should occur first?
   a. Cover and wrap the wound
   b. Lavage with sterile lactated ringers or saline solution
   c. Lavage with hydrogen peroxide
   d. Cover it with a wound ointment

9. When dressing wound, what should be placed directly on the wound?
   a. Sheet cotton
   b. A non-adherent or 4” x 4” gauze pad
   c. A standing bandage
   d. Vetrap

10. You have a wound that has been appropriately cleaned but is going to be left uncovered – what wound product would be best for the early stage of healing?
    a. Pura-Zone
    b. Corona
    c. Vetericyan
Answers

1. _____ from a wound would be deemed a more serious situation.
   - b. Arterial hemorrhaging

   Arterial hemorrhaging is going to result in a high flow rate of bright red blood – because of the rate in which blood loss will occur, a wound that has arterial hemorrhaging is deemed a serious situation.

2. A non-penetrating superficial wound that typically involves a loss of hair would be called:
   - c. An abrasion

3. A puncture wound must heal:
   - b. From the inside first

   A puncture wound is a penetrating wound that is deeper than it is wide. It is very important when dealing with a puncture wound that it heals from the inside out – is the skin heals over the wound 1st it can conceal bacteria and create an infection.

4. The sooner a wound is identified and treated, the better the prognosis for recovery
   - a. True

   The longer it takes to identify or treat a wound, the greater the risk of infection, which can slow the healing process.

5. The use of sutures, skin staples, or gluing during healing is defined as:
   - b. 1st Intention Healing

   1st intention healing, also called primarily surgical closure, is a healing that involves the use of sutures, skin staples, or gluing.

6. What is the first stage of wound healing?
   - c. Inflammation

   The inflammatory stage begins the healing as soon as the injury occurs – during this time, bleeding is slowed while cells associated with clean-up and healing work on the site.

7. A wound that fills with too much granulation tissue due to delayed healing has:
   - a. Proud Flesh

8. When cleaning a wound, what should occur first?
   - b. Lavage with sterile lactated ringers or saline solution

   When first cleaning a wound, the 1st step is to lavage with sterile lactated ringers or saline solution. Water from a hose, while useful for initial debris, should not be used under pressure to lavage.

9. When dressing wound, what should be placed directly on the wound?
   - b. A non-adherent or 4” x 4” gauze pad

   A dressing is a single-use, covering that is designed to be placed directly over a wound. Non-adherent or 4” x 4” gauze pads are two commonly used dressings.

10. You have a wound that has been appropriately cleaned but is going to be left uncovered – what wound product would be best for the early stage of healing?
    - c. Vetericyn

    For the initial/early stages of wound healing, hydrogels are best because they allow healthy cells to move around and clean-up the wound site. Fura-Zone and Corona are too heavy of an ointment for the initial stages of wound healing.
Glossary

**Conduction** – Refers to the transfer of heat from the body to cooler water or the ground if the horse is laying down

**Convection** – A form of thermoregulation, refers to the movement of heat from deep within the horse outward into the air

**Dermatitis** – An inflammation of the skin

**Dermis** – Deeper and thicker layer of skin

**Dew Poisoning** – Also referred to as pastern dermatitis, scratches, mud fever, and greasy heel, a form of dermatitis that affects the distal limb, particularly the fetlock, pastern, and heel

**Epidermis** – Outermost layer of skin, made up of epithelial cells

**Epithelial Cells** – Skin cells

**Evaporation** – A form of thermoregulation, evaporation of sweat from the skin has a cooling effect

**Hypodermis** – Bottommost layer of skin, stores subcutaneous fat (adipose tissue)

**Integument** – Refers to the skin

**Keratin** – The main fibrous component of hair and hooves

**Metabolism** – The utilization of energy

**Radiation** – A form of thermoregulation, involves the air around the horse being cooler than the horse’s body

**Rain Rot** – Also called rain scald, a type of dermatitis caused by a bacterial organism

**Sebaceous Glands** – Found in the dermis, produce sebum

**Sebum** – An oil produced by the sebaceous glands that waterproofs and coats the hairs to prevent from becoming dry and brittle

**Sweat Glands** – Found in the dermis, responsible for releasing secretions on the skin through pores

**Sweat Scraper** – A tool used to remove excess water from the horse’s body after a bath or rinse

**Thermoregulation** – Refers to the ability to regulate core body temperature

**Vasoconstriction** – Narrowing of the blood vessels

**Vasodilation** – Widening of the blood vessels