

# Wound Care

Michael Ball, DVM

Wound care is one of those many horse issues where there are as many opinions regarding treatment as there are horse owners and veterinarians. There are hundreds of agents (both commercial and home-brew) available to paint, spray, smear, gob, and cover wounds. You can use yellow ones, black ones, red ones, and even purple ones. On this point I am, for better or worse, a minimalist; most of the concoctions that have been applied to wounds actually have been shown to delay wound healing or further damage the tissue.

We will discuss some of these topical dressings later in this article. Seeing how most wounds of any nature involve some degree of blood loss (a fact that can be extremely alarming), I think it first would be useful to review some facts about blood.

## Blood Loss (Hemorrhage)

Blood is an essential component of the mechanism whereby oxygen is transferred from the lung to all of the body's organs and tissues. So just how much blood does a horse have? It varies some from breed to breed, but an average value is 80 ml (cc) per kilogram of body weight (100 ml/kg for hot bloods such as the Thoroughbred and 65 ml/kg for cold bloods such as a Percheron). So, the average 1,200 pound horse (545.5 kilograms at 2.2 kilograms per pound) has about 54.5 liters of blood, which is approximately 12.3 gallons.

So, how much can be lost before the danger of shock becomes significant? The general rule of thumb is that an animal will start to show signs of blood loss shock when 10% of his blood volume has been lost. Based on the averages, the adult 1,200 pound horse can lose up to eight quarts of blood before you have to be seriously concerned. Most bleeding from wounds appears to be a much larger volume of blood than it actually is, but any time there is hemorrhage, there should be an attempt to control it. The signs of blood loss shock include weakness, whole body sweating, colic, progressively elevated heart rate, and pale/white mucous membranes.

The use of pressure bandages was discussed in a previous article (The Horse of June 1997), but briefly will be reviewed here. Remember that the first aid kit should contain leg wrap material and elastic bandage material. If the wrap is too thick, it will decrease the ability to apply an adequate amount of pressure to control the bleeding effectively. The bandage should be applied in a tight and smooth manner and in such a way as to apply significant pressure directly over the wound (if possible).

## Wounds/Lacerations

One of the more important facts regarding severe wounds is that the sooner they are noticed and repaired, the better the prognosis, both functionally and cosmetically.

One of the most important aspects of wound management is the ensurance of tetanus protection-both before and after (if a booster is necessary) the horse becomes injured. Vaccination records should be well documented in writing and easily accessible for all of your horses.

A fresh limb wound that is bleeding profusely will need to have a pressure bandage applied. Try and stay calm. A relatively small and non-life threatening quantity of blood can look like a much greater quantity (remember that your horse has to lose more than two gallons of blood before there is a problem). A bandage serves to apply pressure to the hemorrhaging blood vessels and helps to promote blood clotting.

If a large artery is severed, it can be difficult to apply enough pressure, especially if the laceration is some place other than the lower limb, but an attempt should be made. The immediate bandage should not be too thick, as this will limit the ability to apply an adequate degree of pressure for bleeding control. Generally, three sheets of sheet cotton, a shipping bandage quilt, a large bath towel appropriately folded, or several layers of roll cotton are sufficient and can be applied with several rolls of an elastic bandage material over the wound for pressure.

The elastic bandage material should be applied in a smooth, even, firm manner-there must be adequate pressure if it is to be effective at controlling hemorrhage. This sort of bandage might be too tight for long periods of time, but can effectively control bleeding. The bandage can be left in place for 20-30 minutes. If the bleeding is still severe, take off some of the layers and replace them with new material. If the bleeding has subsided, replace the bandage with a clean and more normally applied support bandage.

If the laceration involves the flexor tendons or suspensory ligament, an effort should be made to provide significant support and immobilization. A bandage and splinting should be applied to the leg for transportation or while waiting for veterinary attention. This sort of support and immobilization can help prevent further damage to the injured area if the horse attempts to bear weight. In either case, the horse should be moved as little as possible until evaluation and repairs have been made.

If the wound is older, bleeding might have subsided or substantially slowed, but there could be significant contamination with dirt, debris, and bacteria. With respect to wound repair, there is what is known as the "golden period." This is considered to be the first six hours after the wound was created.

If the wound is appropriately cleansed and repaired during that time, the chances of complication from infection and subsequent repair breakdown are reduced. It is therefore important to have wounds evaluated and repaired as soon as possible.

In the interim, while waiting for repair, cleanse the wound with warm water and an iodine-based surgical scrub. That can decrease the amount of contamination and potentially reduce the risk of complications. In addition to cleansing, the application of a sterile dressing and support bandage can be of great benefit, especially if the horse cannot be seen by a veterinarian right away. If the wound is old (noted by dried-out skin edges or the presence of infection or pus) and has a great degree of swelling and inflammation associated with it, the use of cold hose therapy can be helpful. Cold hydrotherapy can reduce some of the inflammation and aid in the clean-up process until a veterinarian can properly debride the wound.

## Wounds To The Abdomen

Any wound to the abdominal area (often by fence posts or fencing material) should be assumed to have penetrated into the abdomen until proven otherwise. If the abdomen has been penetrated, the risk of developing peritonitis (inflammation of the abdominal cavity) is great. The earlier this problem is treated, the better the prognosis.

The worst case scenario is if a piece of intestine has been punctured or lacerated. Horses with this type of wound usually will develop significantly elevated respiratory and heart rates and show significant signs of shock soon after the leakage of intestinal contents into the abdominal cavity.

If the wound is a large laceration and a piece of intestine is protruding, the horse must be kept still and the bowel supported. Veterinary assistance must be sought immediately. The bowel can be supported with a clean bed sheet wrapped around the belly and fixed over the back of the horse. Do not touch the bowel if possible and make every attempt to prevent it from contacting the ground.

A rare complication of castration is the herniation of intestine through the castration incision. Should this occur, the bowel can be supported as mentioned above with part of the sheet being placed between the hind limbs and over the rump. Again, veterinary assistance should be sought immediately.

### **Eyelid Lacerations**

Lid lacerations often are a preventable problem. By scouring a horse's environment for any potential offending object, you can minimize this type of injury. Be observant and check out the portable stall at a competition before putting your horse in one. In the event that you do find your horse with a torn eyelid, don't panic. Fortunately, the horse's entire face has a great blood supply, and as a result, even the most grotesque of lid lacerations have a fair chance of healing if repaired quickly.

The important thing, as with any wound, is quick intervention. The sooner an eye laceration is repaired, the better the prognosis for uncomplicated healing. You always should have an eyelid laceration, no matter how small, evaluated by a veterinarian due to the importance of the eyelids in protecting the eye. Even small defects in the apposition of the upper and lower lid margin could predispose the horse to future trouble. In addition, whatever trauma caused the lid laceration easily could have caused some difficult-to-detect damage to the eye itself. The eye should be thoroughly examined after lid trauma.

### **Eye Laceration/Puncture**

Numerous objects, as well as blunt trauma, can lacerate, puncture, or rupture the eye. The prognosis for repair of these injuries is variable and depends on the degree of damage incurred and the amount of contamination or infection present. To maximize the chances of successful repair, a veterinarian should evaluate the damaged eye immediately. The more time that passes, the greater the chance of infection setting in and complicating the repair attempt.

### **Foot Puncture/Abscess**

If a single foot is warm and there is sensitivity around the coronary band and/or an increased "pulse" in the foot, the likely cause is a foot abscess. The bottom surface of the foot should be evaluated for any foreign objects, such as a nail, if this is not already the obvious cause of the lameness. Should a foreign object have created a puncture wound in the foot, the object should not be removed until a veterinarian has had a chance to evaluate the situation. If the object is protruding significantly, you can tape some small wooden blocks to the foot or cut the object off close to the foot with wire or bolt cutters to prevent it from going in deeper. But, again, it should not be removed.

The reason for leaving the object in the foot is that, depending on the location of the puncture, your veterinarian probably will want to take a radiograph to determine what deeper structures are involved. The specific location of the puncture can greatly affect the initial treatment plan and the prognosis.

### **How Wounds Heal**

The healing of wounds has been very heavily studied and is broken down into a number of distinct stages. The stages are not absolute, and the processes blend together and overlap. They also are subject to many environmental factors that can interfere with the normal wound healing process, the number one of which is infection.

The first stage of healing is called the immediate stage and spans time zero to one hour. During this stage four things happen: 1) The skin retracts and the wound enlarges (this is obviously affected by the location and how much "extra" skin there is). 2) There is an intense reaction of the blood vessels in the area to contract and slow the loss of blood (the success depends greatly on the size of any lacerated blood vessels). The vessel constriction is short lived and is followed by a dilation of the blood vessels and an influx of chemicals that attempt to clot the bleeding vessels. 3) After about 30 minutes, there is an influx of white blood cells and blood clotting cells into the area. Some of the white blood cells that are infused into the area actually contribute to the inflammation that is starting to occur. 4) Generally within 45-60 minutes, a clot forms followed by a scab.

Obviously these four phases depend on the location and size of the wound, but they generally are the physiologic responses that the body makes in response to all wounds.

Following the "immediate stage" is the so-called "early stage" (one to 24 hours). During that time, inflammation and debridement of the wound predominate. The white blood cells that come in and are responsible for the inflammation also are responsible for killing any bacterial contaminants to the wound (if they are not overpowering). After the inflammation and killing phase, another type of cell comes in and acts as the "clean-up" cell, actually digesting debris in the wound bed. At the later stage of this phase, there is an influx of cells that start the repair process and generation of new tissue. The type of cell that is on the surface (the skin) is called an epithelium cell. In the later stages of this first 24 hours after a wound happens, the epithelial cells begin to migrate into the wound from the normal skin edges.

Next is the "intermediate phase" and occurs over one to seven days after injury. During that time, there is an ingrowth of blood vessels into the wound bed, which brings in new healing factors and aids in the removal of damaged tissue.

The next thing to happen is the influx and development of granulation tissue. The granulation tissue is comprised of a variety of cells that can become more substantial tissue. Some actually can become muscle tissue. However, you should know that many wounds do not heal with the original tissue; much of the replacement tissue can be a fibrous scar tissue that does not perform the same functions as the original tissue that was injured.

The next phase that occurs near the end of this seven-day period is called wound contraction. That is where the skin edges are being pulled together and the wound bed is shrinking.

The final stage of wound repair is called the "late stage" and occurs later than seven days. That is a period where if the damaged tissue has any regenerative capabilities, it is starting to reach a maturation and repair stage. If the damaged tissue does not have much regenerative capability, the scar tissue is maturing and doing its final remodeling.

There are many factors that affect the aforementioned healing stages-infection, location, type of tissue, amount of missing tissue, and type of wound-whether it is a sharp (surgical type) cut or a rough, jagged, ripped apart wound. The one thing for certain is that the sooner a wound is noticed and receives attention, the better the prognosis. Your veterinarian will discuss the particulars regarding your horse's specific wound and care.

## Topical Treatments

As mentioned before, there are many concoctions-both commercial and homemade-to put on wounds. Many of the commercial creams, ointments, and sprays actually have been shown to inhibit the normal healing response. My preference, unless there is a strong indication to do otherwise (ask your veterinarian), is to keep the wound as clean and dry as possible and leave most of the wound preparations in the bottle.

One product that has been shown to improve the healing environment is Preparation H. One of the active ingredients in Preparation H is shark oil; the shark oil has many of the essential fatty acids that improve the health of damaged tissue. It also has an ingredient in it that soothes and relieves the itching that might be caused by healing, thus helping the horse leave the area alone. In the case of proud flesh formation (discussed below), more aggressive therapy might be necessary and should be performed under the supervision of your veterinarian.

## A Word On Cleansing Wounds

There are many products on the market to cleanse wounds, and it should be noted that there are some substances that will do more harm to the tissue than good. The two most common cleansing products are an iodine-based substance (such as Betadine) or a chlorhexidine-based substance (such as Nolvasan). Both of these substances are available in generic forms, which might be a bit cheaper than the brand name product. These scrubs generally are applied with clean tap water and clean cotton or gauze sponges.

It should be noted that the tap water is not sterile, but when used in conjunction with these antiseptic products, it generally is acceptable. Sterile saline also is available in large bottles and is suitable for wound cleansing. It often is preferred by some. The saline is 0.9% sodium chloride, which places it in "balance" with the physiologic composition of the body. Plain water actually is actually slightly off in this balance and can cause the tissue cells to swell and be slightly damaged, but, again, when water is mixed with antiseptic products, this is less of a concern.

Some antiseptic cleansing agents that should be avoided are witch hazel, full strength alcohol, and hydrogen peroxide. Hydrogen peroxide sits on the shelf of many a barn and is used for wound cleansing and flushing, but it has been shown that hydrogen peroxide can cause a great deal of tissue damage and delay healing. Hydrogen peroxide should not be used as a wound cleanser.

Also, various concentrations of iodine often are used as a wound flush. Great care must be taken not to use iodine that is too concentrated or great tissue damage can be done. Iodine comes in both a solution and a tincture. The difference is that the solution is iodine diluted in water and the tincture is iodine diluted in alcohol. Iodine tinctures should be avoided. The typical safe strength of an iodine cleanser or flush is 2%-5% iodine and is often referred to as a solution that is the color of weak tea. Iodine solutions that are of greater concentrations than this come with the risk of burning the tissue and causing more harm than good.

## Proud Flesh

One of the best ways to deal with proud flesh is to make every attempt to prevent it. Quick action and primary repair are the best ways to prevent its development. In addition, keeping the wound as clean and dry as possible and under a firm support bandage can reduce the chances of proud flesh development.

Wounds on the lower limbs are the primary site for proud flesh development. Proud flesh (also called exuberant granulation tissue) often is related to poor wound care. Proud flesh occurs when the healing process goes crazy. There is an over- production of the granular healing tissue, which overwhelms the wound bed and does not allow the edges of skin to meet up with each other and heal properly.

The major treatment for proud flesh is its surgical removal to the point where the skin edges can grow together properly. There are a number of chemical agents designed to destroy the tissue. They can be used alone, in mild cases, or in conjunction with surgical debridement. The removal of proud flesh can be a time-consuming and frustrating procedure and should always be done under the supervision of your veterinarian.

Granulation tissue has a great number of blood vessels within it, and in severe cases, there can be substantial blood loss during the treatment process. In severe cases of proud flesh (or with very large wounds), the process of skin grafting might be employed to obtain an adequate healing response. Again, the best way to deal with proud flesh is to prevent it. Early detection of wounds and their appropriate treatment can greatly reduce the chances of having proud flesh in a wound. During the summer months, a wound with excessive granulation tissue formation might be infected with fly larvae, which can cause the infamous "summer sore" (which can mimic proud flesh). This problem will require special treatment-another reason your veterinarian should be consulted.