



WOUND CARE

- Stages of healing
- Preventing infection
- Why proud flesh forms



COMING TOGETHER TO HEAL WOUNDS FASTER

Silver Honey[®] is the first and only product line to use the unique combination of natural, medical-grade **Manuka Honey** and **MicroSilver BG**[™] to kill 99.9% of bacteria immediately so you can start healing your horse's wounds and skin conditions faster.



DISCOVER THE SCIENCE AT SILVERHONEY.COM ©2022 W.F. YOUNG, INC.

WHEN WOUNDS HFΔ



To help figure out why some equine cuts, scrapes and lacerations fail to mend, an international wound-care expert has compiled a list of the top 12 healing inhibitors.

wound nasty enough for your veterinarian to come out and tend. It's been cleaned and debrided, and now all that remains is the daily routine of bandage changes. But every time you go about the task of removing the old dressing and

or most of us, it's a familiar scenario: Your

horse sustained a

putting on the new, you scrutinize the wound. Is the reddish color around the edges a sign of trouble? Where did that fluid oozing out of the



CENTER: SHUTTERSTOCK.COM; RIGHT: DUSTY PERIN



corner come from? Is this wound healing normally?

Take heart. The odds—and biology —are on your side. The vast majority of equine wounds, both major and minor, heal well and relatively quickly.

"There's no evolutionary advantage to a wound that doesn't heal," says Derek Knottenbelt, BVM&S, PhD, DipECEIM. "They want to heal if they can. And most of them do, with very little intervention from us." Knottenbelt would know: He is one of the foremost veterinary authorities on equine wound healing, having literally written the book on the topic—*Handbook of Equine Wound Management*—and consulted on hundreds of cases around the globe.

And all that experience, he says, has taught him an important lesson: "When a wound doesn't heal promptly there's always a reason, and until you figure out and address that reason, it never will heal," says Knottenbelt. "Figure it out and correct it, and then the horse's body takes over and does a remarkable job and you can take all the credit."

In fact, Knottenbelt has seen so many wound-healing problems that he's streamlined the investigative process, ultimately coming up with a checklist. "It's a pretty famous list, actually, among those of us who deal in these things," he says. "It's the 12 inhibitors of wound healing. If I'm faced with a wound that isn't healing, I go down this list and tick them off, looking for each. Any owner or veterinarian can do the same. It may be just one that's the problem or it may be three or four, but if you identify and correct them, I can assure you the wound will heal."

Here is Knottenbelt's list of factors that stop wounds from healing.

1. INFECTION

Often signaled by red, angry-looking tissue that exudes pus or has a foul odor, infection is the most common reason that wounds don't heal, says Knottenbelt, but it's one of the easiest to remedy if you go about it in the right way.

"The inclination among owners and some veterinarians is to reach for an antibiotic to combat infection, but that's not the correct approach," Knottenbelt says. "Wounds become infected for a reason, and you have to figure out why as you begin treatment or you aren't going to be successful with medications alone."

Some causes of wound infections, such as contamination or reduced immune function, are found elsewhere on this list. Others are more subtle: "A good example is the pH of the wound. Infection loves a very high pH wound," says Knottenbelt. "If you can make the wound slightly more acidic, no bacteria can survive that. What you've got to do

BRONKHORST PHOTOGRAPHY

PAULA DA SILVA/ARND

is find out why the wound is alkaline. A veterinarian experienced in wound healing will know to check for this and how to correct it."

Systemic antibiotics aren't very effective against wound infections, he says: "We all give horses antibiotic injections as we are treating wounds as a preventive, but if infection sets into a wound, the treatment needs to be very localized. Antibiotics circulating in the blood aren't likely to make it to the wound site in sufficient levels to be effective at that stage."

Grabbing a tube of antibiotic cream isn't always the answer either, he adds: "I'm no fan of putting antibiotics on the surface of wounds. For starters, they can be damaging to tissues, destroying the very cells you are trying to protect. If I'm going to use an ointment to kill an infection in a wound, I do it knowing that I'm also going to harm tissues, but I'm at the point when I have no choice." A better approach, he says, is a thorough cleaning of an infected wound to remove debris, dead tissue and reduce the number of bacteria.

2. FOREIGN BODIES

Anything inside a wound that shouldn't be there counts as a foreign body, including wood splinters, dirt, grass and bone fragments. The horse's body will try to expel the material over time, and may ultimately be successful, but wound healing can't continue until that happens.

"Nearly every veterinarian has dealt with a wound that just sits there for a long time and discharges pus without healing," says Knottenbelt. "It can be baffling until we take an x-ray and see a bit of wire embedded in the tissue. Remove that and it heals up quickly and completely."

Knottenbelt says that some foreign bodies in wounds cause more problems than others. For starters, not all materials appear on an x-ray, so a visual inspection or surgical exploration of a wound is sometimes necessary to rule out foreign body contamination. And some materials are more likely to wreak havoc within the tissue. "A bit of glass isn't going to harbor infection as much as, say, a piece of soil or cloth that's been pushed into the wound," he says. Some foreign bodies simply delay healing until the body can eject them; others can lead to a cascade of infection and greater complications. But regardless of what it is, once the material is removed or expelled from the wound, the healing starts right back up again.

Some foreign bodies simply delay healing until the body can eject them; others can lead to a cascade of infection and greater complications.

"Wounds become infected for a reason, and you have to figure out why as you begin treatment or you aren't going to be successful with medications alone," says Derek Knottenbelt, BVM&S, PhD.

3. TISSUE DEFICITS

The natural healing process has distinct phases (see "How Wounds Heal," page 28). Without adequate healthy tissue within the wound to serve as a foundation, however, one or more phases may be delayed or never occur.

"If you've got a tissue deficit, there may not be enough of a biological foundation for new tissue to form over," says Knottenbelt. "And, if you've got a huge wound left to heal by second intention (without stitches) it may stay open forever." The solution, he says, it to provide what the body cannot.

"For instance," says Knottenbelt, "there are new high-tech wound dressings that create a biologic scaffold of sorts, using collagen or amnion or intestines from other animals, that provide the missing foundation and allow tissue to begin to fill in and eventually develop a very normal appearance. These can be incredibly helpful with larger wounds that might not ever close on their own." Your veterinarian will be familiar with these options.

4. MOVEMENT

Tissue that doesn't remain still cannot repair itself, so wounds on a highmotion area of the body may be slow to heal or not heal at all.

"If the wound is over a fetlock, it's easy to see how it will move with each step," says Knottenbelt, "but the same thing can occur with a deep wound on the back from the movement of the muscles underneath it. You may not see it on the surface, but it's just as damaging."

The solution is to immobilize the area, which can be done through a variety of methods. "Keeping the horse in a stall might be enough, but oftentimes you need to do more," says Knottenbelt. "We do a lot of casts for wounds on the feet. If a horse cuts his heel bulb, tissue in that area is going to move with every step. So we put a cast on the limb to address that movement and when we take the cast off 10 days later, it's staggering how well it has done. Some areas of the body are very difficult or impossible to keep still-"you can't immobilize a tongue," says Knottenbelt-but stall rests and splints can solve the problem for

many locations.

5. NECROTIC TISSUE

Dead tissue within a wound will bring healing to a standstill, typically by inducing infection. A veterinarian dealing with a fresh wound will debride it during the initial treatment, removing tissue that is already dead or likely to die quickly. In smaller wounds, you can do the same thing with copious flushing with water or saline solution. But that initial cleanup is not always enough.

"Tissue can die within a wound days, weeks or even months after the initial injury," says Knottenbelt. "It doesn't mean the wound was treated poorly. The death of tissues is sometimes a natural part of the healing process." The only solution at that point is to visually inspect he wound, identify the dead tissue and flush or cut it away.

"We typically cut it back until we see bleeding," says Knottenbelt. "Tissue with a blood supply is alive, so we assume that's where the necrotic tissue ends. We might have to do this a few times before the wound heals."



6. REDUCED 7. POOR BLOOD SUPPLY OXYGENATION

Blood brings to the wound site the constituents essential to healing. Without adequate circulation, tissue repair fails. "If an artery is occluded [blocked], everything down the line to that can be affected," says Knottenbelt, adding that bleeding

Continued trauma

is common in foot

Derek Knottenbelt.

to the heel, where

on it with another

foot, reopening the

the horse may step

wounds, says

BVM&S, PhD,

entire area."

Wounds require oxygen to heal, and they receive that through two routes: The air surrounding the wound and hemoglobin in the blood supply. "A wound lacking oxygen, from either source, will look purple," says Knottenbelt. "A veterinarian will be able to see that. It doesn't

> look like a good, healthy wound."

Leaving a wound uncovered can expose it to more oxygen, of course, but covering it may actually be better. "If you put a semi-occlusive dressing over a wound, you cut off the oxygen it receives from the air," explains

Knottenbelt, "but the bloodstream will begin to bring in more oxygen to compensate for that and it gets delivered to the deepest healing tissues, not just those on the surface, and in a higher concentration."

Knottenbelt says that anemic horses or those who are otherwise ill may not have the red blood cell volume to deliver enough oxygen, even with this technique, and a veterinarian might try something a bit more dramatic. "Hyperbaric chambers have been used as a means of delivering concentrated levels of oxygen to slow-healing wounds," he says. "The horse is placed in a chamber full of concentrated oxygen for a particular length of time each day. These chambers do seem to increase the rate of healing, but it's unclear by just how much."

8. CONTINUED TRAUMA

A wound that is continually aggravated -by rubbing tack, chewing by the horse or tight bandages, for instance-will not heal. "This is very common with foot wounds," says Knottenbelt, "particularly wounds to the heel bulb, where the horse may step on it with another foot, reopening the entire area. Even thick, strong grass can cause enough trauma to wounds on the lower limb to keep them from healing."

The solution is simple enough: Identify and stop the repeated trauma and the wound will heal. This may mean giving the horse some time off from under-saddle work, using a neck cradle to keep him from fussing with the wound or using a different bandaging technique. "Once you stop the trauma, these wounds tend to heal very quickly," says Knottenbelt.





is an indicator of an adequate blood supply and a veterinarian making a close visual inspection can usually identify poor circulation.

You might think that poor blood supply would cause the development of proud flesh-the overgrowth of granulation tissue that prevents epithelialization of a wound-but that's not so, says Knottenbelt. "It is a fallacy that proud flesh develops from a limited blood supply," he says. "There is this idea that lower limbs have reduced blood flow, so proud flesh is likely to develop there. The legs have plenty of blood flow, otherwise they'd fall off. And you can see the blood supply right in the proud flesh if you cut it." Knottenbelt says proud flesh develops because healing has stalled due to some other factor on his list.



SHUTTERSTOCK.COM

7

9. LOCAL FACTORS

This category of healing interrupters includes conditions immediately in and around the wound. "For instance," says Knottenbelt, "a wound may not heal in a very cold or a very hot environment —cells don't function well in either of these. Very wet or a very dry conditions can affect healing. A wound may not heal if there is pocketing in the tissues." To identify these conditions, a veterinarian will have to look at the bigger picture and be a bit creative with solutions.

"You may need to protect the wound with bandaging—most do well with moist, warm dressings—or you may need to move the horse to a less severe environment," says Knottenbelt. Or, the veterinarian may have to alter the wound itself, removing tissue to eliminate pockets or uneven tissue beds.



The general health status of a horse can influence how his wounds heal. "Cushing's disease is the classic example," says Knottenbelt. "Those horses have lowered immune function, so wounds may be slow to heal or prone to infection. A horse on steroid medications or one with a disease like lymphoma could have similar issues."

In less-developed areas of the world, poor nutrition can also lead to delayed wound healing, says Knottenbelt. "This isn't as much of an issue except in Third World countries, but be sure that you are feeding a horse properly when he has a healing wound. Make sure he's getting enough protein in his diet. That's what his body will be using to create new tissue."

11. IATROGENIC IDIOCY

This category, Knottenbelt says, boils down to "stupid things people put on their horse's wounds" and ranges from unnecessary commercial products to harmful homemade preparations.

"The huge majority of equine wounds do just fine with a thorough flushing with warm water or saline and then being covered with a simple hydrogel bandage," he says. For first aid treatments, he says hydrogel dressings, which contain a water-based gel that keeps wounds at an optimal moisture level, can be helpful, as can hydrogel preparations that protect wounds without bandages. "Wounds need nothing else," he says. "Horses have a reputation for wounds that don't heal and I'm certain it's because of the ridiculous salves owners and even some veterinarians will put in the wounds."

Likewise, says Knottenbelt, wounds don't need physical help healing. "Don't scrub wounds that are healing just fine," he says, "and don't pull scabs off. They are there for a reason and keep scarring to a minimum."

HOW WOUNDS HEAL

Wounds that are stitched closed are said to heal by "first intention." The edges of the sutured wound will immediately begin to come together as new cells to repair the area. You won't be able to see the work the body is doing below the surface of the skin, but rest assured it's happening.

For those wounds that cannot be sutured and are left open, the process is called "second intention healing." With each bandage change, you'll be able to observe the three phases of this type of healing:

1. GRANULATION 2. EPITHELIALIZATION

During this phase, the body fills any tissue defect below the level of the skin surface with granulation tissue, which is primarily a mix of blood vessels and collagen. Bumpy and red or reddish yellow, granulation tissue fills the depths of the wound first then works its way to the surface. Granulation tissue in a wound is a sign that healing is occurring. This phase of healing begins after granulation tissue has filled the entire wound defect. At that point, new skin cells—called epithelial cells—begin to form at the edges of the wound and spread across the new bed of granulation tissue to meet each other in the center. You'll recognize epithelial cells as the pinkish looking rim around the granulation tissue of the healing wound. Epithelial cells can move only laterally, not up or down, which is a consequential limitation: The wound-healing complication known as proud flesh occurs when granulation tissue rises above the edge of the wound, preventing epithelial cells from covering it.

3. CONTRACTION

This phase overlaps with epithelialization and is what ultimately reduces the size of the wound. Muscle fibers within granulation tissue contract as the defect is filled, pulling the edges of the wound together. When healing is uninterrupted, this happens quickly, with some equine wounds shrinking literally overnight.

12. TUMOR TRANSFORMATION

When the tissue inside a wound develops tumors, healing stops and managing the case can be very challenging.

"Sarcoids can develop deep inside wounds," says Knottenbelt. "If the horse has a sarcoid somewhere else on his body, it's easy for those cells to be transferred to the wound by flies. Then you have a sarcoid in the wound and it's a very serious situation that has to be recognized and dealt with quickly." Oftentimes, he says, the forming sarcoid is mistaken for proud flesh and owners delay calling the veterinarian or attempt to treat it themselves, making the situation worse.

"If you compare two wounds, one with proud flesh and one with a sarcoid, they can look identical, but

If you compare two wounds, one with proud flesh and one with a sarcoid, they can look identical, but the treatments are diametrically opposite.

the treatments are diametrically opposite," he says. "You need to treat the tumor with cancer drugs; if you try to cut it out like proud flesh, you're going to make it worse. I believe veterinarians should do pathology on every suspected case of proud flesh to ensure it's not a tumor."

GENETIC OBSTACLES TO HEALING

There's one factor that Derek Knottenbelt, BVM&S, PhD, doesn't always include on his famous list of wound-healing inhibitors because it's relatively rare: genetic disease.

"There are a few genetic abnormalities that can affect the physiology of the skin itself and its ability to heal," Knottenbelt explains. "In stock horses there's HERDA [hereditary equine regional dermal asthenia] and there's a similar syndrome in other breeds called epidermolysis bullosa." Both diseases produce defects in the structure of the skin that make it extremely fragile and slow or unable to heal. Caring for these horses can be difficult, with or without wounds, and requires specialized, intense management. Many horses are euthanatized because the condition cannot be controlled.



hen your horse has a wound, even a large one, don't panic. With your prompt attention, and, if needed, help from your veterinarian, chances are it will heal quickly. In the rare event it doesn't, it's still not time to worry too much. With a strategic approach to considering and addressing the 12 inhibitors to wound healing, chances are the cause can be quickly identified and eliminated, and your horse will be healing again soon.

OUR EXPERT

Derek Knottenbelt, BVM&S, PhD, DipECEIM, received his veterinary degree and doctorate from Edinburgh University in Scotland. After 12 years in private practice, he became a professor in equine internal medicine at the University of Liverpool in 1985. In addition to conducting research in equine oncology, dermatology, ophthalmology and wound management, Knottenbelt has written 10 textbooks. He recently retired from academia but now works as a consultant.

WIKIPEDIA











GREASE-FREE FLY SPRAY WITH KILLER NSTINCT

 $\star \star$

MADE IN THE U.S.A.







© 2022 W.F. YOUNG, INC.

HOW TO PREVENT PROUD FLESH

When your horse cuts himself, especially on the lower leg, take steps to ensure that healing proceeds smoothly.

hen your horse shows up at the gate with yet another cut or scrape, it's wise to tend to it right away to head off infection, aid healing and prevent complications.

One complication you'll want to be especially careful to avoid is proud flesh. Also known as exuberant granulation tissue, proud flesh is the excessive growth of the connective tissue and blood vessels that begin to fill in a healing wound. In severe cases, the mounds of pink tissue can take on a cauliflower-like appearance and protrude beyond the surface of the skin. New skin is unable to grow over the tissue, and healing stalls. Proud flesh develops most frequently in wounds on the lower legs, but under the right circumstances it can appear anywhere on the body.

Several factors increase the risk for proud flesh, including the wound's severity, level of contamination and location—the potential for disruption of fragile healing tissue in wounds over joints and other mobile areas makes them more vulnerable. Also, some horses are simply more prone to developing proud flesh than others. Consult your veterinarian if your horse





has a wound that "gapes" when he moves, affects a joint, tendon or bone, or contains embedded debris or other contamination. In some wounds, sutures may be the best option, and your veterinarian will want to address any other issues that might compromise healing.

In most cases, you can probably manage your horse's minor injuries yourself. But if you have any doubts do not hesitate to call your veterinarian. It is far better to get healing on the right path from the outset than to try to compensate once complications have developed.

Rinse the wound well. Dirt and debris—including hair, rope fibers, fragments of metal or wood, or dead tissue—can create chronic inflammation and infection that inhibits proper healing and encourages growth of proud flesh. Saline solution, which has the same salt concentrations as blood, is the safest way to flush impurities out of a wound without disrupting injured tissues. If you don't have any saline at hand, water from a hose can do the job. In fact, the cool water has the added benefit of helping to reduce swelling and inflammation. Inspect the area closely to make sure it is completely clean.

> Apply appropriate treatments. Flushing a clean wound with a dilute antiseptic wash, such as Betadine or Nolvasan, can



reduce the risk of infection even further. If you choose to apply a wound ointment, use a water-based gel during the earliest stages of healingthese help protect the tissues without inhibiting healing. At the outset, avoid heavy, greasy ointments such as ichthammol-these are more effective for protecting tissues during the later stages of healing. At any stage of healing, your best bet is to stick to products labeled for use on horses. Meat tenderizers, hemorrhoid creams and other home remedies may control inflammation, but they will also damage normal tissue and may inhibit healing.

3 Bandage, if appropriate. Apart from superficial scrapes, almost any wound on the lower leg will benefit from bandaging to keep it clean while it heals. You'll want to first cover the exposed tissue with non-stick gauze or

IN FOCUS: Proud flesh (overgranulation)

Definition: overgrowth of granulation tissue that rises over the edges of a wound, making healing impossible
Causes: Proud flesh is more likely to develop in

wounds to the lower limbs, wounds that remain contaminated with foreign matter, and those in more mobile areas.

► Signs: The granulation tissue—which fills in the deeper portion of a wound that penetrates all the way through the skin—will take on a lumpy, reddish-yellow, rubbery appearance. If infection is present, it may exude fluids and have a noxious odor.

▶ Diagnosis: X-rays or ultrasound may be used to look for damaged bone or embedded foreign matter. Testing may be necessary to distinguish proud flesh from sarcoids and various types of infections that can create similar-looking lesions in open wounds. ▶ **Treatment:** Surgical removal of the excess growth is the primary treatment for proud flesh. For more moderate cases, a topical corticosteroid may shrink the tissue enough to allow proper healing. The leg may be placed in a splint or case to keep it still while healing progresses. Skin grafts may be used for larger wounds. other wound dressings that won't adhere to the fragile healing tissues. Wounds above the level of the elbow or stifle can often be left open to heal; the relative immobility of the horse's torso means the healing tissues won't be disturbed as often, and these areas are likely to remain cleaner. You'll want to change the bandage at least daily while healing progresses; more frequent changes may be necessary if the gauze is

getting soaked with exudates.

4 Keep your horse still. Too much motion in a healing wound pulls at the tissues and can



prevent the skin from closing over it. Bandaging will help keep the limb still as your horse heals, and for larger wounds your veterinarian may recommend splinting. Keep your horse in his stall or in a small corral or round pen until the wound is stable.

5 Seek help quickly if healing stalls. Even with the best of care, some wounds may develop proud flesh. Call your veterinarian immediately if you start to detect rounded, bumpy tissue in a healing wound. In addition to curbing the growth of proud flesh, it's important to rule out similar-looking conditions, such as ulcerated sarcoids or various fungal, bacterial or parasitic infections.

Applying a bandage

Bandaging is an important part of wound care. Not only does it help keep the wound clean, it can hold topical medications in place. But it's important to do the job carefully. A bandage that is too loose or too tight can slow healing or even make a wound worse. If you're unsure of your technique, ask your veterinarian to help you improve your skills.

Before you start, you'll need to choose the best dressing for your horse's wound. For years, sterile gauze squares were the primary choice for covering the wound surface before applying the wraps to cover it—and these will still get the job done. However, a better option may be one of the newer products designed to keep the healing tissues moist, such as calcium alginate or foam pad dressings. Although it was once believed that the best way to promote healing was to let a wound dry out, recent research has shown that open wounds will close faster and with less risk of infection if the surface remains evenly moist. In addition, specialized dressings are now available that can help debride infected wounds or restore moisture to wound surfaces that dried out before the injury was discovered. If you're unsure of which type to use, ask your veterinarian for a recommendation. As with any product, read the labels carefully and follow the instructions.

Once you have wound dressing, you'll also need rolled gauze, padding such as a quilt or cotton sheet, selfadhesive bandage and elastic bandaging tape (Elastikon).

Wrap the rolled gauze just above the wound, pulling it just tightly enough to remain in place but not so hard as to stretch out the weave. Make sure it lies smoothly and that each layer overlies the preceding layer by about 50 percent. The highest risk of injury to healing tissues come from shifting or slippage of this gauze layer.

2. When you reach the level of the wound, place the gauze pad or other dressing over the exposed tissue, holding it carefully to ensure it lies flat with no wrinkles. Then continue with wrapping the gauze roll down the leg to cover the dressing and extend beyond its lower edge.

3. Wrap the cotton padding around the leg, taking care that it lies flat. **4** Apply an additional layer of rolled gauze to help hold the padding in place as you continue wrapping.

5. Start the self-adhesive wrap about a half-inch below the top of the padding and work downward, taking care to overlap it by about half with each turn and to prevent it from bunching up or wrinkling. Also leaving about a half-inch of padding exposed at the bottom, continue wrapping back up the leg for a total of two layers. You want to finish with a smooth, snug covering.

6 To help secure more firmly, apply two or three rounds of elastic bandaging tape at both the top and bottom, overlapping both the horse's leg and the bandaging material by two or three inches.

Keep your horse comfortable and ready to ride with Magic Cushion.

You can't always control the footing, but you can help undo its impact. Proven to reduce heat and calm inflammation, Magic Cushion® hoof packing provides fast-acting, long-lasting relief to hooves and legs. So your horse recovers from this ride in time for the next.

DON'T LET

THE

Save on Magic Cushion® at Absorbine.com.

©2019 W.F. Young, Inc.

