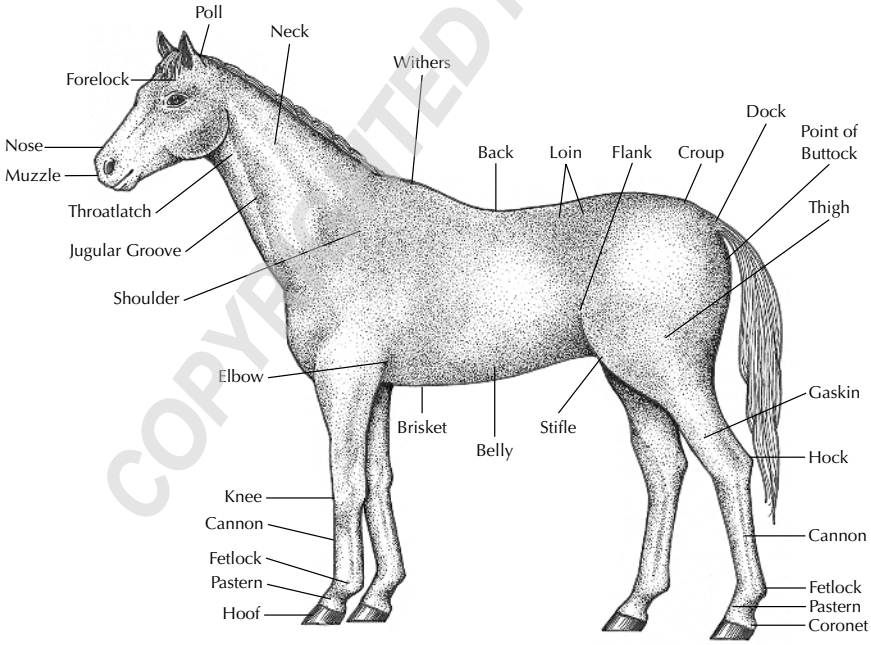
1

EMERGENCIES

Emergency care is just that—care applied to a potentially serious condition that must be dealt with immediately. One of the cardinal rules in dealing with any emergency is for you to remain calm. If you panic, you won't be thinking clearly and you will panic your horse. Take a deep breath, quietly reassure your horse, and then do what is necessary. Don't hesitate to ask for help and remember that your horse is relying on you.



Basic anatomy of the horse.

Handling and Restraint

A horse who is frightened, injured, or in pain is a potential danger to himself and to his handlers. Do not handle or attempt to treat an agitated horse without professional assistance. In most cases, an injured horse will need to be given an intravenous sedative or be tranquilized before treatment can begin.

Most horses should be restrained for routine procedures such as shoeing, applying insecticides, floating the teeth, deworming, and giving injections. When restrained, a well-socialized horse recognizes that he is going to be handled and submits readily to the customary treatment.

The method of restraint will depend on the horse's disposition and spirit, his prior training, the duration of treatment, and whether the procedure is likely to cause pain. In general, it is best to begin with the least severe restraint that will allow examination.

Some specific methods for handling and restraint are discussed in this section.

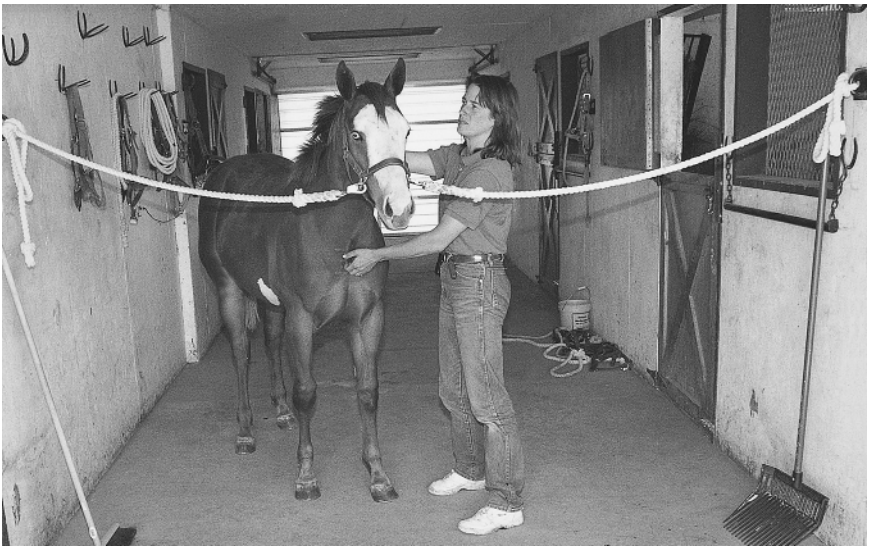
Head Restraint

Even when a procedure is relatively minor and painless, it is still important to have an assistant restrain the horse's head. The assistant should hold the lead and be prepared to divert the horse's attention. The assistant should stand on the same side as the examiner, to keep the horse from wheeling into or kicking the examiner. Both should be on the left side whenever possible, because horses are used to being handled on the left.

A simple and effective method of restraining the head is to have the assistant hold the horse's muzzle with the left hand and the nape of the neck with the right (as shown in the photo at the top of page 3). To prevent the horse from ducking, the left thumb is inserted beneath the noseband of the halter. This method is useful for procedures such as floating the teeth.

Secure the horse with a halter and a lead before beginning any sort of examination or treatment.

This is a simple way for an assistant to restrain the horse's head for a short procedure, such as giving an injection.



When working alone, it is safer to cross-tie the horse than to tie him to a fence or post.

When an assistant is not available, you can restrain the horse's head by cross-tying the horse between two walls or posts. The tie ropes should be anchored firmly at about the level of the horse's shoulders and snapped onto the halter. Tie the anchored ends with a slipknot for quick release.

Halter and Lead

The first step in dealing with a frightened or difficult horse is to gain control with the halter and lead. Approach the horse from the front while talking in a soothing and familiar manner. Never approach a horse from the rear or out of his line of vision.

If the horse is agitated, take as much time as necessary to gain his confidence. It is best to approach from the left, because horses are used to being handled from that side. Rub the horse on the shoulder or neck for a few moments to establish physical contact and to help calm the horse. Then slip the halter over his nose and tighten the buckle.

A chain across the gums is an effective restraint and keeps the horse from backing or rearing.

The chain can be placed through the horse's mouth, as shown here, or over the nose.

Always lead from the left side, holding the shank about 18 inches from the halter. Hold the lead firmly but do not wrap it around your hand or thumb; this would be unsafe if the horse decided to pull back or jump away and the lead was wrapped around your hand. When administering treatment, don't tie the lead shank to a fence or post. Many horses restrained in this manner for treatment will sit back forcefully on their haunches, invariably breaking the fence or a piece of tack. If the horse realizes he can escape by force, it will be extremely difficult to tie that horse up in the future. If you are forced to work alone, cross-tie the horse as described in the previous section.

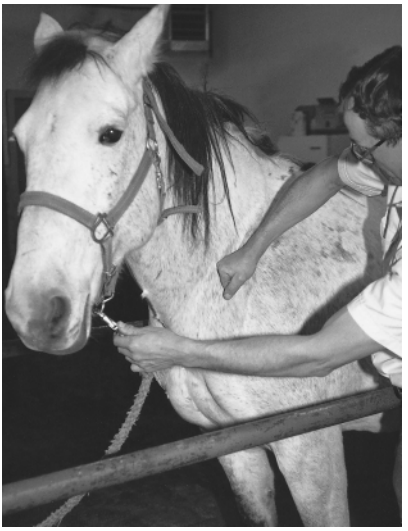
The least aggressive restraint is to pass the lead shank under the horse's chin. This restraint will suffice for most handling situations. However, if the horse rears, do not jerk on the chain as it could cause him to fall over backward.

A chain shank or war bridle should be removed whenever a horse is tied. If the horse becomes upset and pulls back, the bridle or shank will constrict around his head or muzzle and cause serious injury.

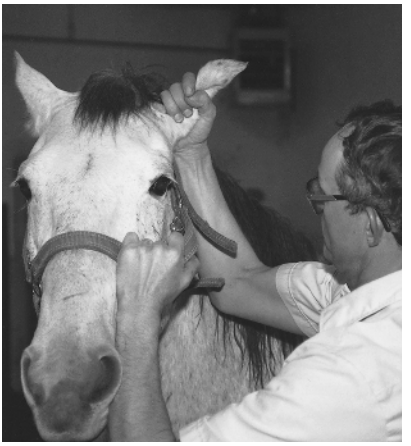
Another method that can be used for a horse who refuses to advance on the lead (for example, through a door) is to blindfold the horse and then either lead or back him through the door.

Twitches

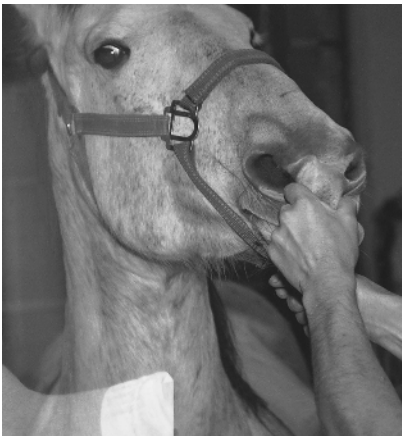
Twitches are among the oldest and most widely used methods of restraint. A twitch is thought to stimulate the release of endorphins in a manner similar to acupuncture and to produce sedation comparable in degree to chemical tranquilization.



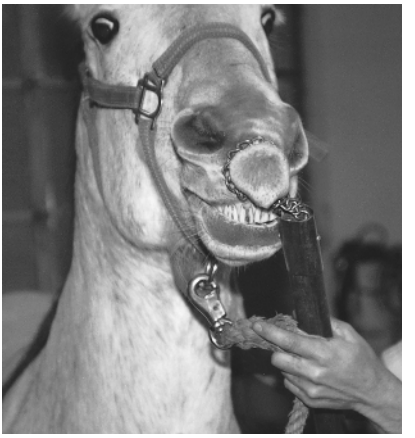
Apply the skin twitch by grasping a fold of skin in front of the shoulder.



The ear twitch can make the horse head-shy. It should be used only by experienced handlers.



To apply a nose twitch, grasp the horse's upper lip to steady his head . . .



. . . then slip the loop over the horse's nose with the lips folded under.

Some horses should not be twitched. Because of past abuse, they may greatly resent the twitch and even fight it. These horses should be restrained in some other manner.

The skin twitch is applied by grasping a fold of skin just in front of the horse's shoulder. It may provide enough distraction for you to perform short procedures.

The ear twitch is applied by grasping and squeezing the ear with the heel of the hand pressed against the horse's scalp. Slight pressure is exerted

A lip twitch attached to the halter is useful when an assistant is not available.

downward. The major disadvantage of the ear twitch is that it can make the horse head-shy. Therefore, the ear twitch should be used cautiously and only by experienced horsemen.

The nose twitch and the lip twitch are used most often. However, they tend to lose their effectiveness when the skin becomes numb. To delay numbness, the twitch can be applied loosely and tightened as necessary. To apply a nose twitch, first grasp the upper lip between thumb and fingers to steady the head. Slip the loop over the horse's nose with the lip folded under so that the lining of the mouth is not exposed. Tighten the loop by twisting the handle.

The most humane twitch is a lip twitch attached to the halter so that it can't come off during the procedure. This twitch is a simple clamp with a string and a snap attached to the handles. Place your hand through the open twitch, firmly grasp the horse's nose, slide the twitch onto the nose, squeeze the handles together, wrap the string around the handles, and attach the snap to the halter to hold it in place. The lip twitch is especially useful when you are unfamiliar with horse restraints or are obliged to work alone.

Handling the Feet

To pick up the front foot, stand to the side in case the horse strikes out. Slide your hand down the horse's leg while squeezing on either side of the flexor tendon above the fetlock. It may be necessary to push the horse onto the opposite leg while picking up the foot and flexing the joint.

When preparing to pick up a back foot, approach from the side. A horse who resents being approached from behind sometimes (but not always) gives evidence by moving away and taking weight off the leg in preparation for kicking. For safety reasons, do not approach him from the rear.

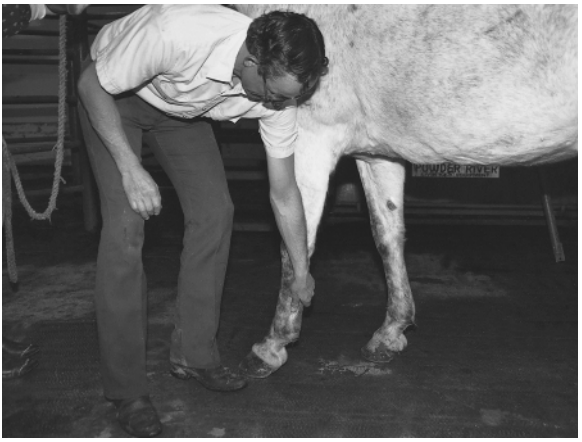
To pick up the foot, slide your hand along the inside of the leg behind the cannon bone and draw the leg forward, then pull backward. Lift the leg and support it on your thigh. Note that the stifle joint is extended and the hock and toe are held in a flexed position. This helps to restrict voluntary movement of the leg.

When releasing the foot, simply reverse the procedure.

Preventing the Horse from Kicking

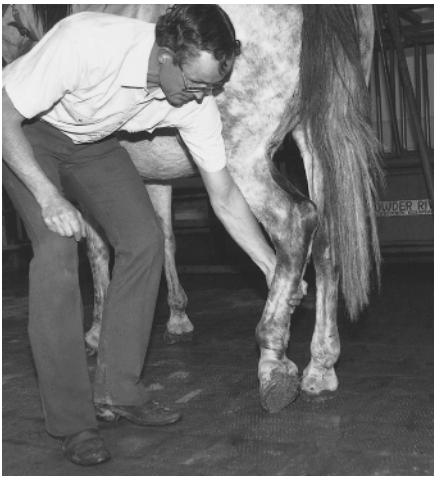
If a horse is inclined to kick while undergoing treatment, lifting a front leg will prevent him from doing so because a horse cannot kick with one foot off the ground. The leg can be restrained by tying it up with a rope or strap. The rope or strap should be equipped with a quick-release mechanism in case the horse loses his balance. You'll need a sideline to tie up a back leg.

Hobbling the hocks prevents kicking and allows the horse to bear weight on all four legs. This is important for long procedures or when a *mare* has to support the weight of a mounting *stallion*.

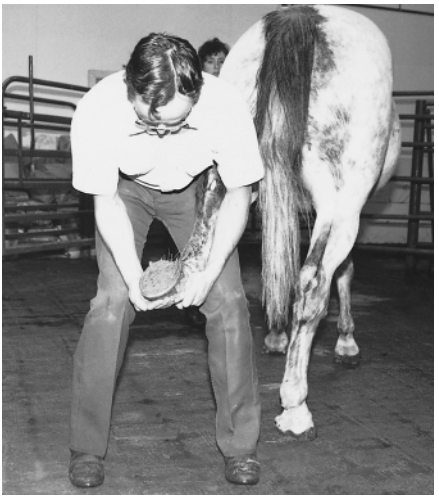


When picking up the front foot, be sure to stand well to the side.

Flex the horse's knee to examine the sole and frog.



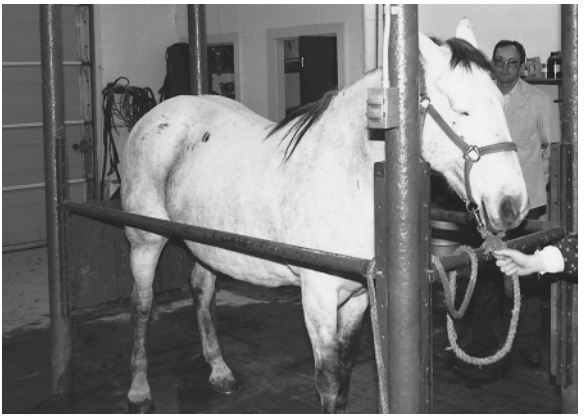
When picking up the back foot, approach the horse from the side. Slide your hand inside the cannon bone and draw the leg forward.



Support the leg on your thigh with the horse's stifle joint extended. This makes it difficult for the horse to pull free.

Stocks

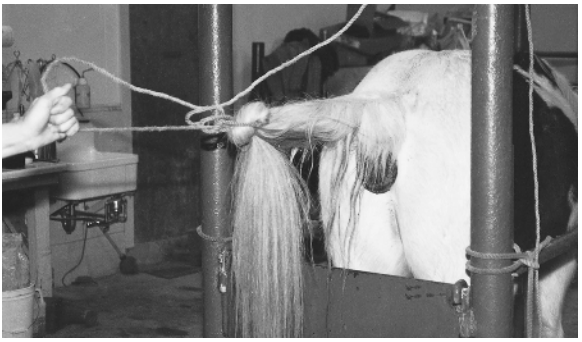
For rectal and vaginal examinations, it is most convenient to restrain the horse in stocks or a *palpation* chute. In addition, stocks are particularly suitable for dental extractions and surgery on a standing horse. A partition at the back of the stock protects the examiner from being kicked. Once in stocks, the horse should be backed up against the partition to prevent him from kicking over the top.



A stock with a kicking partition at the back is a safe restraint for rectal and vaginal examinations.

Tail Restraint

Tying a rope to the tail and pulling it straight back is a useful restraint for rectal and vaginal examinations. The rope should be held by an assistant and not tied to a stationary object.



The tail restraint should always be held by an assistant.

Restraining a Foal

Young *foals* who are not halter-broken but are wearing a halter should not be restrained by grasping the halter. These young horses often react by rearing back and falling. This can lead to a brain concussion or a spine fracture. Instead, another kind of tail restraint is a good way to control weanlings who are not halter-broken. (Forced tail flexion should be used with caution in older horses, because coccygeal fractures and nerve injuries may occur.)

Grasp the foal's tail and pull it over the back in an arc while encircling the base of his neck with your other arm. This provides effective immobilization for short procedures, such as passing a stomach tube or giving an injection.

Nursing foals become excessively agitated and difficult to control if separated from their dams. If the foal cannot be approached easily in the paddock or field, mother and foal should both be led into a small enclosure such as a smooth-walled stall. The foal is then cornered and can be easily held with one arm encircling his chest and the other behind the rear legs above the hocks. The tail can be held over the back, as well.

This is the correct method for restraining a foal.

Chemical Restraint

Intravenous sedation is indicated for horses who resist physical restraint, and for those in pain or about to undergo a painful procedure. Intravenous sedation is given by injection into the jugular vein. Depending on the circumstances, your veterinarian may select a drug or drug combination from the following classes.

- Phenothiazines (such as acepromazine) are tranquilizers that act on the central nervous system to produce calming and deep drowsiness. Rarely, they produce extreme anxiety, muscle twitching, dropping of the penis, sweating, and convulsions.
- Narcotics (such as morphine, Demerol, and butorphanol) are painkillers. When used in pain-free horses, they may produce excitation, apprehension, and increased muscular activity. Constipation and urinary retention are possible side effects. Untoward effects can be reversed by giving an antidote.
- Xylazine (Rompun) combines both tranquilization and pain control. It has a good margin of safety and can be used in combination with other drugs for better sedation and anesthesia. It is often the drug of choice for procedures requiring intravenous sedation. Drugs such as detomidine (Dormosedan), romifidine (Sedivet), and other alpha-2 agonists are gaining popularity.

Keep in mind that the effects of tranquilizers and sedatives vary. A horse may still kick or strike even though he seemed to be fully tranquilized. Exercise the same precautions as you would around a horse who is not sedated. Sedated horses should be kept away from *forage* and concentrate until they are fully awake to prevent choking.

For more information on tranquilizers and sedatives, see *Anesthetics and Tranquilizers* (page 588).

Abdominal Pain (Colic)

Sudden, severe pain in the abdomen in the horse is called *colic*. A horse with colic appears anxious and upset, and may kick at his abdomen, roll on his back, kick his feet in the air, break out in a sweat, and strain as if he is trying to pass urine or stool.

Treatment: Colic is a symptom rather than a specific disease. There are a great many diseases associated with signs of colic. Accordingly, a veterinary examination is necessary to determine the nature and seriousness of the problem. For more information, see *Colic* (page 381).

Burns

Burns are caused by fire, electric shocks, skin friction, frostbite, and caustic chemicals. Acids, alkalis, solutions that contain iodine, and petroleum products are the most common causes of chemical burns. Saddle sores, galls, rope burns, and friction injuries are discussed in chapter 4, "The Skin and Coat."

Frostbite usually affects the ears and can lead to a loss of skin and cartilage, leaving a cropped appearance.

Steam, hot water scalds, and flame burns cause damage to the skin and underlying tissue in proportion to the length and intensity of exposure. With a surface burn you will see skin redness, occasional blistering, perhaps slight swelling, and the burn is painful. With deep burns the skin appears white and the hair comes out easily when pulled. Paradoxically, deep burns are not necessarily painful because the nerve endings may have been destroyed. When more than 20 percent of the body surface is involved in a deep burn, the outlook is poor. Fluid losses are excessive and shock will quickly set in.

Treatment: Treat chemical, acid, and alkali burns by flushing copiously with large amounts of lukewarm water. To be effective, this must be done immediately after the exposure.

Apply cold water compresses or ice packs to local burns for 30 minutes to relieve pain. Replace as compresses become warm. Clip away hair and wash gently with a mild soap, such as Ivory. Do not break blisters, because they provide a natural barrier to *infection*. Apply a topical antibiotic ointment such as Furacin, Silvadene cream, or triple antibiotic ointment. Aloe vera cream has medicinal properties and is particularly soothing on mild burns. Do not apply oil, grease, or iodine-containing surgical cleansing solutions, because they are irritating and will increase the depth of the burn and thus the potential for infection.

Burns can be treated by leaving them open to the air, or closed under a bandage or dressing, depending on the location of the injury. Where practical, protect the wound with an outer gauze dressing and change it daily (see *Wounds*, page 32).

Cardiovascular Collapse

Too much stress on the heart can lead to sudden circulatory collapse. In racehorses, the stress is that of maximum physical exertion over a relatively short period of time. In hard-working performance and endurance horses, the stress is less than the maximum but occurs over an extended period of time. The initial signs are those of exhausted horse syndrome (page 13). If the exercise is continued, collapse will follow.

Sudden Collapse

During maximal physical exercise, the cardiac output of a racehorse increases to seven times normal, while the heart rate increases to 200 beats per minute (from a normal 35 to 45 beats per minute at rest). Blood flow through skeletal muscles may be 20 times that of the resting state.

Under such circumstances, the equine heart muscle labors under a sustained deficiency of oxygen, a condition known as *hypoxia*. A switch to *anaerobic* metabolism may sustain the heart for some time, but with continued exertion, a point is eventually reached at which the heart can no longer supply enough oxygen to the muscles. At this point, the heart may decompensate and the horse will collapse.

Cardiac *arrhythmias* are thought to be the immediate cause of sudden cardiovascular decompensation (see *Arrhythmias*, page 318). Contrary to popular belief, horses with arrhythmias usually do not drop dead under the rider. The first indication is an abrupt drop in running speed. This alerts the rider and allows her to pull up and dismount.

The ability of a horse to tolerate cardiovascular stress is directly related to his athletic fitness. Fitness depends on how well the horse has been trained and conditioned. To achieve a high level of conditioning, a horse must be free of health problems, including *anemia*, valvular disease, myocarditis, intestinal *parasites*, bronchitis, and heaves—which compromise the efficiency of the heart and lungs.

Prevention: To prevent sudden cardiovascular collapse in the competition horse, it is important to:

- Screen all horses for cardiac and respiratory diseases.
- Correct any medical problems that may exist.
- Institute a program of graduated exercise, aimed at obtaining maximum athletic fitness.
- Monitor and recognize the immediate signs of exhaustion and rapidly correct dehydration and electrolyte deficits.

Exhausted Horse Syndrome

This syndrome affects performance and endurance horses experiencing submaximal exertion over an extended length of time. After a short period of hard work, the glucose stored by the muscles is depleted. When this happens, energy is generated by switching from glucose metabolism (*aerobic* metabolism) to fat metabolism (anaerobic metabolism). Anaerobic metabolism produces lactic acid and waste products, which accumulate and cause fatigue of heart and skeletal muscles.

The *basal* metabolic rate increases 10 to 20 times during sustained exercise. This generates a tremendous amount of heat that must be dissipated to maintain normal body temperature. Sweating is the chief way of dissipating body heat in the horse. As much as 6 to 12 gallons (22 to 45 l) of sweat can be lost during an endurance ride in hot, humid weather. Sweat contains substantial amounts of calcium, potassium, bicarbonate, sodium, chloride, and magnesium—minerals in the body known collectively as *electrolytes*.

When fluid and electrolyte losses are severe, horses may lose the ability to sweat—even if they have a high rectal temperature (see *Heat Stroke*, page 19).

Recognizing Impending Exhaustion

During endurance races, problems are recognized at veterinary checkpoints or mandatory rest stops. An exhausted horse shows an elevated rectal temperature along with a fast heart rate, flared nostrils, and a rapid breathing rate. If the horse is severely overheated, the breathing rate can actually be greater than the heart rate. *Capillary refill time* is prolonged to greater than three seconds (see *Capillary Refill Time*, pages 315 and 622).

After 15 minutes of rest, the heart rate should drop to less than 70 beats per minute and the breathing rate to less than 40 breaths per minute. If this does not happen, the horse should be rested until it does.

While resting, the exhausted horse may experience muscle cramps, tremors, and stiffness, and be unwilling or unable to move. This condition, called endurance-related *myopathy*, is not the same as the tying-up syndrome, although most of the signs are similar (see *Exertional Myopathy*, page 18).

A badly exhausted horse is apathetic, depressed, weak, unwilling to drink water, and appears *febrile* and dehydrated. He may sweat at a reduced rate or not at all. Such horses should be removed from the race to prevent sudden heart failure or metabolic collapse.

Thumps

This condition, which veterinarians call synchronous diaphragmatic flutter (SDF), occurs in some exhausted horses. Thumps is caused by low blood calcium in association with other electrolyte deficiencies. It is characterized by spasmodic contraction of one or both flanks, forceful enough to be felt or heard by the rider.

The thumps themselves are caused by rapid contractions of the diaphragm in unison with the heartbeat. The diaphragmatic nerves that pass over the heart apparently respond to its electrical field. Thumps should be considered a warning sign and an indication for further veterinary evaluation.

Post-Exhaustion Syndrome

Some severely exhausted horses do not recover after rest. These horses remain depressed, with persistently elevated heart and breathing rates. Liver and

kidney failure can occur. This may lead to death. Reports have shown that horses with post-exhaustion syndrome have received phenylbutazone (Butazolidin) or another nonsteroidal anti-inflammatory drug (*NSAID*) early in the course of exhaustion. Therefore, these drugs should be withheld until the horse is adequately rehydrated.

Treating the Exhausted Horse

Stop all exercise. Move the horse to a cooler environment. As soon as possible, begin to replace fluids and electrolytes. If the horse is unable to drink, replacement solutions should be given, either intravenously or orally by stomach tube. Large volumes (usually several gallons) of a solution that contains electrolytes are required. A suitable oral electrolyte solution can be prepared by adding 1 tablespoon (18 g) of ordinary table salt and 1 tablespoon of Lite salt to 1 gallon (3.8 l) of water. (Lite is half sodium chloride and half potassium chloride. It is available at most grocery stores.)

This solution is high in chloride, the electrolyte lost in the greatest amount in sweat. It does not contain calcium, because large amounts of calcium may cause sudden heart failure. A number of commercial oral rehydrating solutions (containing sodium, potassium, chloride, calcium, bicarbonate, and glucose) are commercially available through your veterinarian or a horse supply store.

Continue administering the electrolyte solution until the horse recovers sufficiently to drink water on his own.

Lower the horse's body temperature as described in *Heat Stroke* (page 19). Thumps will disappear spontaneously with rehydration. A replacement solution containing calcium will expedite this process.

Preventing Exhausted Horse Syndrome

A horse on a long, physically depleting ride needs an average of 1 gallon (3.8 l) of water per hour. Statistics show that horses who drink frequently during an endurance race are much less likely to drop out of the race than those who do not. Consequently, endurance riders condition their horses to drink small amounts of water frequently during training. Accordingly, allow and encourage your horse to drink often. Frequent drinks during any strenuous athletic endeavor enable the horse to alleviate thirst, which is a signal of dehydration. Common sense dictates small, frequent drinks to help cool the equine athlete and prevent dehydration.

Sodium, chloride, potassium, bicarbonate, calcium, and magnesium are lost in the sweat and urine in proportion to the severity of stress, temperature, humidity, and individual sweating characteristics of the horse. To compensate for these losses, it may be advisable to give controlled amounts (perhaps several quarts; 1 quart is roughly 1 liter) of electrolyte-enriched water during the race, even though it may not be needed by all horses. It will not harm the horse as long as fresh water is available and the horse is allowed to drink as much as

he wants during rest stops. However, keep in mind that water is far more essential than electrolytes. Do not give electrolyte water as a substitute for fresh water.

It is best not to feed a competition horse before a race, even though some people like to feed hay to an endurance horse at rest stops. Feeding diverts energy to digestion. This energy can be better used in supplying cardiovascular and musculoskeletal needs.

Dehydration

Dehydration is a loss of body fluids. It is not recognized until a 5 percent or greater loss of body weight in water occurs. A loss of 12 to 15 percent of body weight in water is life threatening.

Signs of dehydration include weakness, *depression*, dry mucous membranes (of the mouth and tongue), sunken eyeballs, prolonged *capillary refill time* beyond three seconds, and a heart rate over 60 beats per minute. Circulatory collapse and shock may result in death if not promptly treated.

The degree of dehydration can be estimated by testing skin elasticity. When the skin of the lower chest above the elbow is picked up into a fold, it should spring back into place. In horses with moderate to severe dehydration, the skin stays up in a ridge or returns to its original position very slowly (see *Hydration*, page 623).

Severe dehydration is most often caused by profuse diarrhea, prolonged physical exertion in hot weather, acute gastric dilatation, intestinal obstruction, or *peritonitis*. The dehydration is often complicated by *sepsis*, electrolyte deficit, and acid-base imbalance.

Dehydration also can occur with fever, heat stroke, choking (esophageal blockage), and loss of consciousness (which prevents the horse from drinking).

Treatment: Mild dehydration (for example, due to water deprivation for 24 hours) can be corrected by allowing the horse to drink small quantities of water at frequent intervals. Electrolyte-enriched water, as discussed in *Exhausted Horse Syndrome* (page 13), is indicated when water loss is accompanied by electrolyte loss. Excessive sweating and watery diarrhea are signs of severe electrolyte loss.

Moderate to severe dehydration must be treated by a veterinarian. Corrective replacement solutions containing water and electrolytes can be given by a nasogastric tube, assuming the horse does not have an intestinal problem such as diarrhea or bowel obstruction. The maximum rate of administration by nasogastric tube should not exceed 6 quarts (5.7 l) of fluid every two hours.

Intravenous solutions are commonly given through the jugular vein, although other sites are available if circumstances require. Because the intravenous route allows for the most rapid replacement of fluid, it is the one most preferred to treat severe dehydration and ongoing fluid losses.

Large volumes of intravenous fluids are needed to correct moderate to severe dehydration.

Electric Shock

Horses who chew on electrical insulation can receive a shock sufficient to cause electrocution. Improperly grounded electric hot walkers are another cause of fatal shock. A horse can also be electrocuted by coming into contact with a pool of water electrified by a downed wire.

Horses are occasionally killed by lightning. A horse does not have to be struck directly to be killed. A tall tree with deep roots and spreading branches can serve as a conduit for a bolt of lightning, conducting electricity through the ground to any animal standing in the immediate vicinity of the tree during a thunderstorm. The same thing can happen when lightning hits ponds and fences or barns and stables that are not protected by lightning rods.

Most lightning strikes are fatal. The singed hair and skin of the dead horse gives evidence of the cause of death.

A horse who survives a major shock will often be knocked unconscious. Upon recovering, the horse may demonstrate signs of brain injury, including dizziness, altered vision, excitability, or paralysis.

Many electrocutions can be prevented. Faulty stable wiring should be replaced. Electric wire that is accessible to horses and rodents should be encased in metal housing. Lightning rods should be attached to all stables and

barns. Electric walkers should be grounded. Fence wire connected to wooden posts is not well grounded and will conduct electricity. To ground the fence, replace a wooden post with a metal post every 50 yards. Keep horses out of wet pastures and away from small ponds during thunderstorms.

Exertional Myopathy (The Tying-Up Syndrome and Azoturia)

The tying-up syndrome and *azoturia* represent escalating degrees of the condition called exertional myopathy. Azoturia is the more severe form. Both tend to occur in heavily exercised horses who continue to consume a high-carbohydrate diet even when the exercise is temporarily discontinued. As the activity is resumed, the horse finds it difficult and painful to move. The term "Monday morning disease" was first used to describe this condition, since it was noted that horses who were rested and fed a working ration over the weekend often became stiff and sore when they returned to activity on Monday.

Exertional myopathy is caused by an accumulation in the muscles of a carbohydrate storage compound called glycogen. Glycogen storage occurs to a much greater extent in horses than in other animals, and even more so in horses with exertional myopathy. Excess glycogen accumulates in the muscles. Then, as the horse exercises, muscle glycogen is rapidly broken down to release blood sugar. This produces lactic acid that builds up to levels well beyond that which can be removed by metabolism. Lactic acid damages skeletal muscle and causes the release of muscle enzymes and *myoglobin*. Myoglobin is excreted in the urine and blocks the *nephrons*, causing acute kidney failure.

The tying-up syndrome, which is the milder form, occurs in race and performance horses during the cooling-out period after vigorous exercise. Signs include stiffness, muscle tremors, anxiety, and sometimes sweating. The muscles of the loin and hindquarters, in particular, are tense, hard, and painful. If myoglobin, a protein in heart and skeletal muscles, is found to be present in the urine, the condition becomes azoturia.

Azoturia signs begin 15 to 60 minutes after the beginning of exercise. The horse becomes anxious, sweats profusely, and has a rapid pulse. This is followed almost immediately by a stiffening of all major muscles, accompanied by staggering and wobbliness in the rear. Collapse is possible.

A horse with severe azoturia passes reddish-brown to black urine containing myoglobin pigment. With a mild attack, pigment will be found only on chemical analysis. The presence of myoglobin in the urine confirms the diagnosis and rules out endurance-related myopathy, colic, tetanus, and laminitis.

Signs of exertional myopathy may resemble those of colic. It is important to distinguish between these two conditions, since exercising or even walking a horse with acute exertional myopathy could be fatal.

Treatment: On first suspicion of exertional myopathy, stop all activity and enforce absolute rest. Any degree of activity, even returning to the stall, makes the condition much worse. Speak to the horse calmly to relieve anxiety. Cover the horse with a blanket and obtain veterinary assistance.

Tranquilizers such as acepromazine and pain relievers such as meperidine (Demerol) may be prescribed by your veterinarian to help relieve anxiety and may aid in the removal of lactic acid by improving circulation to the muscles. Oral NSAIDs, particularly naproxen, are especially effective in relieving stiffness and should be continued for several days. DMSO may be used by your veterinarian for its antioxidant properties. If corticosteroids are given, they should be administered only during the first few hours. They should not be used thereafter, because steroids have been implicated in causing attacks of exertional myopathy and can contribute to the development of laminitis.

Severely affected horses are given large volumes of intravenous fluid, along with an oral electrolyte solution, by stomach tube to promote urine flow and protect the kidneys from myoglobin damage. Thiamin and pantothenic acid (both present in the B complex vitamins) facilitate the elimination of lactic acid.

The outlook for recovery is good if the horse remains standing and his pulse returns to normal within 24 hours. It is good if the horse lies down but is able to maintain a *sternal position*. If the horse remains on his side and his pulse does not return to normal within 24 hours, the *prognosis* is guarded. Death can occur from acute kidney failure or the complications of prolonged *recumbency*.

Prevention: A horse who has recovered from exertional myopathy is susceptible to recurrent attacks. In part, these attacks can be prevented by withholding grain during periods of inactivity, maintaining a regular exercise program with at least some exercise each day, and starting all exercise activities slowly and increasing them gradually.

Vitamin E and selenium may prevent recurrent attacks in some horses. Commercial preparations are available. They can be given once a month by injection or can be added in low doses to the horse's feed. In certain geographic areas, your veterinarian may recommend checking your horse's blood level of selenium to avoid toxicity from oversupplementation. The anticonvulsant drug Dilantin has been reported to prevent some recurrences.

Heat Stroke

Heat stroke is an emergency that requires immediate recognition and treatment.

Horses dissipate body heat primarily through sweating. When the humidity is high and air temperature is close to body temperature, cooling by sweating is not an efficient process. The horse then attempts to dissipate heat through rapid air exchange, or panting.

Common situations that predispose horses to overheating include:

- Being transported in hot, poorly ventilated trailers
- Sustained exercise in warm, humid weather
- Being excessively dehydrated as a consequence of water deprivation, extreme exertion, or fever
- Anhydrosis (the inability to sweat in response to exercise or heat production)

Heat stroke begins with symptoms similar those described for *Exhausted Horse Syndrome* (page 13). If these symptoms go unchecked, the thermoregulatory mechanism malfunctions and the horse's body temperature may rise to as high as 115°F (46°C)—well above levels of heat exhaustion. The horse loses his ability to sweat and becomes disoriented and unsteady on his feet. The situation is now critical and the horse may collapse and die at any moment.

Treatment: Rapid cooling must begin at once. While awaiting the veterinarian, move the horse to shade and spray him repeatedly with cold water. Apply ice packs or alcohol sponges to the neck, flanks, and lower extremities. Electric fans are a very effective way of cooling a horse, although they are not always available. Cold water enemas, administered by the veterinarian, produce rapid cooling.

Dehydration is always a factor and should be corrected with large volumes of intravenous fluids containing electrolytes (see *Dehydration*, page 16).

Prevention: Heat stroke can be prevented by limiting the horse's exposure to predisposing situations and by ensuring that hard-working and endurance horses drink frequently during prolonged exercise.

Insect Stings, Spiders, and Scorpions

The stings of bees, wasps, yellow jackets, and ants all cause painful swelling at the site of the sting. If an animal is stung many times, he could go into shock as the result of absorbed toxins. Rarely, a hypersensitivity reaction called anaphylactic shock can occur if the horse was previously exposed to the same toxin (see *Anaphylactic Shock*, page 28).

The bites of black widows spiders, brown recluse spiders, and tarantulas also are toxic to animals. The sign is sharp pain at the site. Later, the horse can develop chills, fever, and labored breathing. An antivenin of equine origin is available to treat the black widow bite. The antibiotic dapsone is recommended to treat brown recluse spider bites. Tarantula bites may require treatment with an antihistamine.

The stings of centipedes and scorpions cause a local reaction and, at times, severe illness. These bites heal slowly. Poisonous scorpions (two species) are found in southern Arizona.

To treat stings and bites:

1. Identify the insect, if possible.
2. Remove any embedded stinger with tweezers, or scrape it out with a credit card (only bees leave their stingers behind).
3. Make a paste of baking soda and water and apply it directly to the sting.
4. Use ice packs to relieve swelling and pain.
5. Apply calamine lotion or Cortaid to relieve itching.

Poisoning

A poison is any substance that is harmful to the body. This includes manufactured products such as medications and cleaning solutions. Animal baits are palatable poisons that encourage ingestion. Horses will readily consume them if given the opportunity. This also makes them an obvious choice for intentional poisoning.

Pastures contain a variety of plants, often unrecognized but potentially toxic. Poisonous substances can also be found in roughages and improperly stored grain and hay. Accidental ingestion of these compounds is the most common cause of poisoning in horses.

The great variety of potentially poisonous plants and forages makes identification difficult, but most farm extension agents and veterinarians will be familiar with the common toxic plants and forages prevalent in your area.

Ingesting plant and forage toxins causes a complete spectrum of toxic symptoms. They include mouth irritation, drooling, tongue paralysis, diarrhea, rapid heart rate, rapid labored breathing, cyanosis, depressed senses, abnormal gait, staggering and loss of balance, limb paralysis, muscle tremors and convulsions, collapse, coma, and death. Some plants can cause sudden death without any warning signs. For more information on specific poisonings, see *Forage Toxicities* (page 427). Feed meant for cattle can also be poisonous to horses.

Medications, when given in an overdose or by the wrong route, may cause death. For this reason, only people who are properly trained should give intravenous medications. Occasionally, a horse will suffer anaphylactic shock (see page 28) when given a drug by injection due to a profound allergy to the drug.

Seizures caused by strychnine and other central nervous system poisons may be mistaken for epilepsy. Immediate veterinary attention is needed in cases of poisoning. In contrast to a poison seizure, epileptic seizures are brief, seldom last more than a minute, and are followed by a quiet period in which

the horse appears dazed but is otherwise normal. Seizures caused by poisoning are often continuous or recur within minutes. Between episodes the horse is agitated and sweating, and may exhibit tremors, loss of coordination, weakness, colic, and diarrhea.

General Treatment for Poisoning

If poisoning is suspected, contact your veterinarian at once. If possible, locate the source of the poison and remove it to prevent further contact. Have it with you to answer any questions from the veterinarian. If the horse is down and having difficulty breathing, clear the airway (see *Shock*, page 27).

If your horse ingests an unknown substance, it is important to determine whether that substance is a poison. Most products have labels that list their ingredients, but if the label doesn't tell you the composition and toxicity of the product, call the ASPCA Animal Poison Control Center at (888) 426-4435 for specific information. The Poison Control Center has a staff of licensed veterinarians and board-certified toxicologists on call 24 hours a day, every day of the year. You will be charged a consultation fee of $50 per case, which can be charged to most major credit cards. There is no charge for follow-up calls in critical cases. At your request, they will also contact your veterinarian. You can also log onto www.aspca.org and click on "Animal Poison Control Center" for more information.

In some cases, you can call the emergency room at your local hospital, which may be able to give you information about how to treat the poison. Specific antidotes are available for some poisons, but they cannot be administered unless the poison is known, or at least suspected by the circumstances. Some product labels have phone numbers you can call for safety information about their products.

Signs of acute poisoning appear shortly after ingestion. Residual poison may be present in the horse's stomach. A gastric tube should be passed into the stomach and the contents suctioned and removed. The stomach is then washed out with large volumes of water to remove as much residual poison as possible.

After gastric *lavage*, an activated charcoal slurry is introduced through the stomach tube. The charcoal absorbs chemicals remaining in the stomach and small intestine. To prepare the slurry for an adult horse, mix 1 pound (453 g) of activated charcoal with 2 quarts (2 l) of water; for a foal, mix ½ pound (226 g) of charcoal with 1 quart (1 l) of water.

The next step is to prevent further absorption by eliminating the poison from the digestive tract. This is accomplished by giving a laxative immediately after the charcoal slurry. The two laxatives recommended for this purpose are magnesium sulfate (Epsom salts) and sodium sulfate (Glauber's salt). Sodium sulfate is preferred when used with activated charcoal, but either laxative is acceptable. Both are dissolved in water and given at a rate of 1 pound

(453 g) of laxative per gallon (3.78 l) for a mature horse; or ⅓ pound (150 g) of laxative per ⅓ gallon (1.26 l) for a foal. The laxative can be repeated in 8 to 12 hours.

Mineral oil is a mild laxative and intestinal protectant. It is preferred for some poisonings to prevent the absorption of toxins. The recommended dose is 3 to 4 quarts (3 to 4 l) for a mature horse and 1 pint (½ l) for a foal. Mineral oil must be given by stomach tube.

Large volumes of intravenous fluids are given in most cases of acute poisoning to support circulation, treat shock, and protect the kidneys. A large urine output may assist in eliminating the poison. Corticosteroids are often given for their anti-inflammatory effects. A horse in a coma may benefit from tracheal *intubation* and artificial ventilation during the phase of respiratory depression.

Convulsions caused by poisons are associated with prolonged periods of oxygen deficit and the potential for brain damage. Continuous or recurrent seizures should be controlled with intravenous diazepam (Valium), phenobarbital, pentobarbital, or methocarbamol (Robaxin).

If the horse has a poisonous substance on his skin or coat, wash the area thoroughly with soap and large volumes of water, or give the horse a complete bath in lukewarm water. Even if the substance is not irritating to the skin, it should be removed. Gasoline and oil stains can be removed by soaking the area with mineral or vegetable oil. Work the oil into the coat. Then wash the coat with a mild detergent such as Ivory soap.

Poison Baits

Animal baits containing strychnine, sodium fluoroacetate, arsenic, phosphorus, zinc phosphide, metaldehyde, or other poisons are used in rural areas to control gophers, coyotes, and other animals. In stables and barns they are used to eliminate rodents. These poisons are now being used less frequently because of livestock losses, concerns about persistence in the environment, and the potential to poison companion animals and children.

A variety of toxic signs occur when poison baits are ingested. The signs include hyperexcitability, tremors, loss of coordination, weakness, seizures, coma, respiratory depression, and circulatory collapse. These poisons are extremely toxic and may produce death in a matter of minutes.

Strychnine

This is available commercially as coated pellets dyed purple, red, or green. Signs occur less than two hours after ingestion. The first signs are agitation, excitability, and apprehension. They are followed by intensely painful convulsions with rigid extension of all limbs. The horse arches his neck and is unable to breathe. Any slight stimulation, such as touching the horse or making a loud noise, will trigger a seizure.

Treatment: Treat as described in *General Treatment for Poisoning* (page 22). Intravenous pentobarbital or phenobarbital is given during the first 48 hours to control seizures. Administer oxygen. Maintain a quiet environment and avoid unnecessary handling.

Sodium Fluoroacetate (Compound 1080)

This highly potent rat and gopher poison is often mixed with cereal, bran, and other rat feeds. Signs of poisoning include agitation, profuse sweating, trembling, straining to urinate or defecate, a staggering gait, and terminal convulsions. Because of its rapid action, sudden death without observed signs may be the only indication of poisoning.

Treatment: Treat as described in *General Treatment for Poisoning* (page 22). An antidote (glyceryl monoacetin) is available from chemical supply stores. Intravenous calcium chloride or calcium gluconate may be needed to correct low serum calcium.

Arsenic

This heavy metal is often combined with metaldehyde in slug and snail baits, and may be in ant poisons, weed killers, and insecticides. Arsenic has a very rapid action and a major potential for unintentional poisoning. Fortunately, its use has been greatly curtailed. Death can occur before symptoms are observed. In less acute cases, the signs are severe colic, weakness, trembling, staggering, salivation, diarrhea, and paralysis.

Treatment: Treat as described in *General Treatment for Poisoning* (page 22). A specific antidote (dimercaprol, also called British anti-Lewisite or BAL) is available. It should be given as soon as the diagnosis is suspected.

Metaldehyde

This poison, often combined with arsenic, is used commonly in rat, snail, and slug baits. It looks and tastes like dog food. The contents of the horse's stomach may have an odor of formaldehyde. Signs of toxicity include excitation, drooling and slobbering, uncoordinated gait, muscle tremors, and weakness that progresses to recumbency in a matter of hours. Death is by respiratory failure.

Treatment: Treat as described in *General Treatment for Poisoning* (page 22). Intravenous diazepam (Valium) or pentobarbital is given to control tremors. There is no antidote.

Phosphorus

This chemical is present in rat and cockroach poisons. The horse's breath may have the odor of garlic. The first signs of intoxication are colic and a hemorrhagic diarrhea. These signs may be quickly followed by coma and death.

Alternately, some horses experience a symptom-free interval lasting two to four days, which is then followed by signs of liver and kidney failure.

Treatment: There is no specific antidote. Treat as described in *General Treatment for Poisoning* (page 22).

Zinc Phosphide

This substance is found in rat poisons. Zinc phosphide in the stomach releases phosphine gas, which has the odor of garlic or rotten fish. Intoxication causes rapid, labored breathing, colic, weakness, stumbling, ataxic gait, convulsions, and death within two days.

Treatment: Treat as described in *General Treatment for Poisoning* (page 22). There is no specific antidote, but the stomach should be *lavaged* with 5 percent sodium bicarbonate, which raises the gastric pH and delays the formation of gas.

Rodenticide Anticoagulants

Rat and mouse poisons containing dicumarol-related compounds block the synthesis of vitamin K. Vitamin K is essential for blood clotting; a deficiency of vitamin K results in spontaneous bleeding. There are no signs of poisoning until the horse develops spontaneous bleeding and passes blood in the urine or stool, bleeds from the nose, or hemorrhages beneath the gums and skin. The simultaneous use of nonsteroidal anti-inflammatory drugs such as phenylbutazone may increase the bleeding.

The first-generation anticoagulants (warfarin, pindone) require repeated consumption to produce a hemorrhagic effect. However, the newer and more commonly used second-generation anticoagulants (of the bromadiolone and brodifacoum classes) require just a single exposure.

A closely related condition is dicumerol poisoning. Dicumerol is found in sweet clover contaminated by a mold. Eliminating moldy hay will prevent this problem.

Treatment: Treatment of spontaneous bleeding caused by all anticoagulants involves administering fresh whole blood or frozen plasma in amounts determined by the rate and volume of blood loss. Vitamin K1 is a specific antidote. It is given immediately by subcutaneous injection and repeated at intervals as necessary until the activated clotting time (ACT) returns to normal. Second-generation anticoagulants remain in the horse's system for several weeks and require prolonged observation and treatment.

Insecticides

Insecticides (also discussed in chapter 2, "Parasites") constitute a large group of toxic compounds to which the majority of horses are exposed. They are therefore a potential risk for poisoning.

Organophosphates and Carbamates

These compounds, used extensively in pesticides and dewormers, are the most frequent cause of insecticide poisoning. Organophosphates include dichlorvos, malathion, coumaphos, stirofos, haloxon, and trichlorfon. The most commonly used carbamates are sevin, pyrantel pamoate, and pyrantel tartrate. Organophosphates are a particular problem when topical insecticides are applied to a horse shortly after he has been dewormed with either dichlorvos or trichlorfon. This combination of two sources can result in overdose and toxicity.

Signs of toxicity with organophosphates and carbamates include hyperexcitability, colic with a tucked-up abdomen, muscle tremors, patchy sweating, profuse salivation, diarrhea, and a stiff-legged gait progressing to staggering. Collapse, followed by respiratory failure, is terminal. Seizures do not occur with insecticide poisoning.

The organophosphate haloxon has been shown to produce recurrent laryngeal nerve paralysis in foals. In adults, it produces paralysis of the anus, bladder, and pelvic limbs.

Treatment: Following oral ingestion, remove contents from the stomach by gastric tube and prevent absorption by administering activated charcoal and a sodium or magnesium laxative as described in *General Treatment for Poisoning* (page 22). Hyperexcitability and salivation are controlled with intravenous atropine. Repeat subcutaneously as needed. The specific antidote for organophosphate poisoning is 2-PAM (protopam chloride). It should be given as soon as the diagnosis is suspected. Tranquilizers and morphine should be avoided, since they may exacerbate symptoms.

Chlorinated Hydrocarbons

Chlorinated hydrocarbons, of which the prototype is DDT, are used in field and seed sprays, and as dusts against plant pests. Their use has been curtailed because of persistent toxicity in the environment. Only lindane and methoxychlor are approved for use around livestock.

Chlorinated hydrocarbons are readily inhaled and easily absorbed through the horse's skin. Toxicity can occur from repeated or excessive exposure. Signs of toxicity occur rapidly. They include hyperexcitability with twitching of the face, followed by muscle tremors that begin at the head and progress backward to involve the neck, shoulder, trunk, and rear legs. Seizures and convulsions are followed by respiratory paralysis and death.

Treatment: There is no specific antidote. Following oral ingestion, flush out the stomach and administer activated charcoal followed by mineral oil and a laxative as described in *General Treatment for Poisoning* (page 22). Seizures are controlled with intravenous diazepam (Valium) or pentobarbital. For skin exposure, the coat should be washed thoroughly with soap and water to remove residual insecticide.

Shock

CIRCULATORY SHOCK

Circulatory shock is a state of low blood flow. It is the result of cardiac output that is insufficient to meet the body's needs for oxygen. Adequate cardiac output requires a healthy heart, open blood vessels, and sufficient blood volume to maintain pressure. Any condition that adversely affects one or more of these will produce shock.

The body attempts to compensate for inadequate circulation by increasing the heart rate, constricting the blood vessels in the skin, and maintaining fluid in the circulation by reducing the output of urine. This becomes increasingly difficult when vital organs are not getting enough oxygen to carry on these activities. After a time, shock becomes self-perpetuating. Prolonged shock causes death.

Common causes of shock are dehydration (from profuse diarrhea or excessive sweating), hemorrhage, severe colic, peritonitis, blood-borne infection, heat stroke, snakebite, electrocution, poisoning, and major trauma. Foal *septicemia* is the most common cause of shock in neonates.

Treatment: First, evaluate the horse. Is he breathing? Does he have a heartbeat? What is the extent of his injuries? Is he in shock? If the horse is in shock, summon your veterinarian and proceed as follows:

1. If the horse is unconscious, check to be sure the airway is open. Clear secretions from the mouth with your fingers. Pull out the tongue to prevent it from blocking the airway. If possible, maintain the horse in a position in which the head is level with the body.
2. Allow the horse to assume the most comfortable position. An animal will naturally adopt the least painful position that allows him to breathe.
3. Control bleeding as described for *Wounds* (page 33).
4. To slow the progress of shock:
    - Calm the horse and speak soothingly.
    - When possible, splint or support broken bones before moving the horse.
    - Cover the horse with a coat or blanket to provide warmth. Do not wrap him tightly.

Veterinary treatment involves rapid rehydration with large volumes of intravenous electrolyte solutions to maintain blood pressure and tissue perfusion (blood flow into the tissues). Other steps that may be indicated include administering oxygen, blood transfusions, corticosteroids, antibiotics, and various drugs to support the circulation.

The outlook depends on the cause of the shock and how quickly treatment is initiated.

Anaphylactic Shock

This is an acute hypersensitivity reaction that develops after a horse has been exposed to an *allergen* to which he is highly sensitive. The allergens most frequently involved in anaphylactic reactions are the penicillin antibiotics, vaccines, and the immune serums, such as antivenins. Signs of *anaphylaxis* are produced by histamine and other substances released by mast and basophil cells (which are reactive white blood cells) in response to the challenge of the allergen.

Anaphylaxis can be localized or generalized (*systemic*). For example, a local reaction to an insect bite may consist only of itching and a hivelike swelling around the site of the bite. With a systemic reaction, the itching, swelling, and *hives* become generalized, or appear elsewhere on the body. A severe systemic anaphylactic reaction is accompanied by anxiety, sweating, marked difficulty breathing, diarrhea, a drop in blood pressure, shock, collapse, and, eventually, death.

Treatment: Early recognition of severe anaphylactic shock is essential. Sudden anxiety with difficulty breathing following either a vaccination or the administration of a drug are indications to treat. The specific antidote is epinephrine. Mild reactions are treated with 1 to 2 ml of a 1:1,000 epinephrine solution given intramuscularly (*IM*) or subcutaneously (*SC*). Life-threatening reactions require the immediate administration of 4 to 8 ml of the 1:1,000 epinephrine solution IM or SC, or 3 to 5 ml of the 1:10,000 solution intravenously (*IV*) via the jugular vein over three to five minutes. (Note the different solutions for IM and IV administration.) Repeat epinephrine every 15 minutes as necessary. If time permits, a permanent IV line should be established, as further medications and large volumes of fluid may be necessary to support the circulation.

An injectable corticosteroid (dexamethasone 0.1 mg per pound, 453 g, of body weight) is frequently administered for its anti-allergic effects. An antihistamine such as pyrilamine maleate, at a dose of 0.5 mg per pound by IM or IV injection, is often sufficient for a mild local reaction, and is useful in a severe reaction as a complement to the medications already listed.

Prevention: As a precaution, do not administer a drug or vaccine that has produced any sort of allergic reaction in the past, including hives. Drugs used for treating anaphylactic shock should be available in the medical supplies of all facilities that routinely give injections to horses.

Snake and Lizard Bites

Poisonous and nonpoisonous snakes are widely distributed throughout North America. Snakebites tend to occur during the spring and summer, when snakes are most active. Horses are usually bitten on the nose. In general, the bites of

nonpoisonous snakes do not cause swelling and pain. They show teeth marks in the shape of a horseshoe (no fang marks; see the illustration on page 30).

In the United States there are four poisonous species: rattlesnakes, cottonmouth moccasins, copperheads, and coral snakes. The diagnosis of a poisonous snakebite is made by the appearance of the bite, the behavior of the animal, and the identification of the species of snake. (Kill it first, if possible.)

Pit Vipers (Rattlesnakes, Moccasins, Copperheads)

Identify these species by their large arrow-shaped heads, the pits below and between the eyes, their elliptical pupils, and the presence of fangs in the upper jaws. The most dangerous snake for horses is the large rattlesnake commonly found in the western and southwestern United States. It is easily identified by its characteristic rattle.

Pit viper venom produces red blood cell *hemolysis* and destroys tissue by breaking down proteins. It also depresses the heart.

The strike of the rattlesnake, and to a lesser extent that of other pit vipers, causes tissue swelling around the bite. When the horse is bitten on the nose (most common), the swelling may be mistaken for a bee sting or a spider bite. Identification of two puncture wounds in the skin (fang marks) will reveal the true cause.

In a severe case, however, the whole head, including the nose, eyelids, and ears, may be swollen to an extreme degree, giving rise to nasal obstruction and difficulty breathing. A frothy, bloodstained discharge may drain from each nostril.

Signs and symptoms depend on the size and species of snake, the location of the bite, and the amount of toxin absorbed by the horse. Most horses show few signs other than swelling at the site of the bite. With a severe reaction, the horse will become depressed and weak. When death occurs, it is caused by respiratory failure or cardiac arrest.

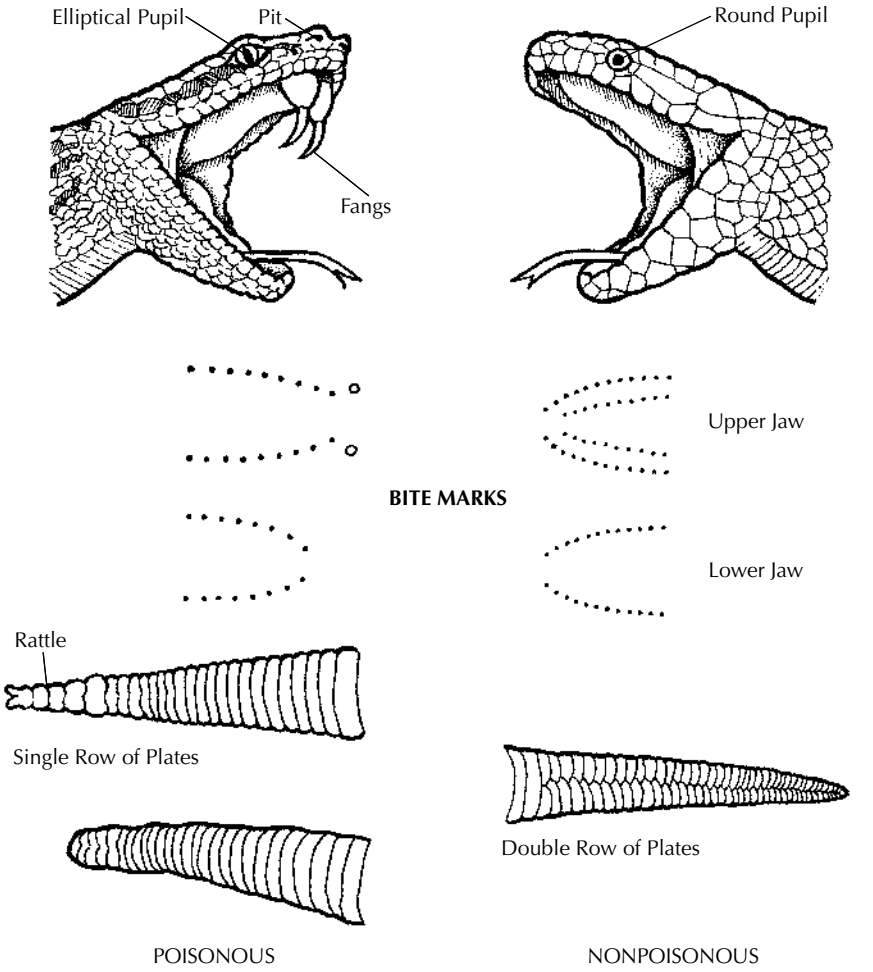
Coral Snake

The coral snake, found primarily in the Southeast, is an infrequent cause of snakebites. This snake has a retiring nature and lives in a habitat different from that of most horses. Identify the coral snake by its rather small size, small head with a black nose, and vivid body bands of red, yellow, white, and black, with the red and yellow bands always next to each other. The fangs are in the upper jaw.

There is a species of nonpoisonous snake that resembles the coral snake. In this snake, the black bands are bordered by yellow bands on both sides.

The local reaction in the horse is less severe than it is with a pit viper, but the pain is excruciating. Look for the fang marks.

Coral snake venom is neurotoxic (destructive to nerve tissue). Signs include paralysis, convulsions, and coma.



Characteristics of pit vipers and nonpoisonous snakes. Note the elliptical pupil, pit below the eye, large fangs, characteristic bite, and single row of subcaudal plates on the belly of the pit viper.

Lizards

Two species of poisonous lizard are found in the United States, both in the Southwestern states. They are the Gila monster and the Mexican bearded lizard. The bites of these lizards could be fatal to a horse.

Lizards have a tendency to bite and hold on. If the lizard has a firm hold on the horse, pry open the lizard's jaws with pliers and remove it.

Treating Snake and Lizard Bites

Fortunately, because of the large size of the adult horse, poisonous snake and lizard bites are rarely fatal. Foals are at somewhat greater risk of systemic reactions and death.

The first step is to identify the reptile and look at the bite. If the animal is not poisonous, cleanse and dress the wound as described in *Wounds* (see page 32). If it appears the horse has been bitten by a poisonous snake or lizard, summon your veterinarian and proceed as follows.

1. Restrain the horse. Bites are extremely painful. If the horse is recumbent, treat for shock, see *Shock* (page 27).
2. Keep the horse quiet. Venom spreads rapidly if the horse is active. Excitement, exercise, and struggling all increase the rate of toxin absorption.
3. If the bite is on the leg, apply a constricting bandage (a handkerchief or a strip of cloth) several inches above the bite. You should be able to get a finger beneath the bandage. Loosen the bandage for 5 minutes every hour.
4. Cold water packs can be applied to the bite at 15-minute intervals to reduce swelling. Ice packs, however, cause additional tissue damage and should not be used.
5. Washing the wound may upset the horse and increase venom absorption. Later, under controlled conditions with the horse sedated, the wound should be thoroughly cleansed, irrigated, and disinfected.
6. Incising the fang marks and applying suction in the field is not a practical undertaking for most equine snakebites and may increase the horse's anxiety and struggling. In particular, do not attempt to suck out the venom, as you could absorb the toxin.

Antivenins are available through your veterinarian. They are not always necessary for the adult horse but may be indicated for the foal. To be maximally effective, antivenin must be given within two hours of the bite. Swelling and nasal obstruction respond to corticosteroids. Snake and lizard bites frequently become infected. Antibiotics, tetanus shots, and wound care are important.

Sudden Unexplained Death

A horse may be found dead without obvious explanation. Intentional poisoning comes to mind first. However, most poisonings are accidental and not the result of malicious intent. All unexplained deaths should be investigated in an effort to establish the cause. Measures may need to be taken to protect other animals on the property.

A postmortem examination in the field may disclose the cause of death and thus eliminate the suspicion of poisoning. Diagnostic centers can provide full *necropsy* services to identify the cause of death. If the cause is not readily apparent, samples of blood, urine, stomach contents, and tissue from the kidney, liver, brain, spleen, hair, or hoof should be taken and sent to a laboratory for tissue and chemical analysis. It is also important to send samples of feed, water, weeds in the area, and suspect animal baits. Cost needs to be taken into account when deciding how thoroughly to pursue the investigation, because these studies can be expensive.

The following are some causes of sudden unexplained death, listed in approximate order of frequency.

- Peritonitis caused by acute gastric dilatation and ruptured gastric ulcer, colonic perforation, or intestinal strangulation
- Ingesting poisonous plants
- Forage toxicities, including botulism, moldy corn poisoning, sorghum toxicity, other mycotoxins and molds, blister beetle poisoning, and monensin (commercially known as Coban or Rumensin, this substance is a feed supplement commonly used for cattle and poultry that is toxic to horses)
- Cardiac arrhythmias causing cardiac arrest from unsuspected heart disease
- Ingesting poison baits
- Lightning strikes
- Fatal infections, including anthrax, equine infectious anemia, bacterial diarrhea, rabies, and equine piroplasmosis
- Head and neck trauma caused by falls or running into posts and walls
- Anaphylactic shock caused by insect stings, spider bites, or vaccinations
- Poisonous snakebites

Despite laboratory studies, the exact cause of death may never be determined. The most probable cause of death is then based on circumstantial and laboratory evidence and the clinical judgment of your veterinarian.

Wounds

In caring for wounds, the most important considerations are to first stop the bleeding and then to prevent infection. Be prepared to restrain the horse before you treat the wound (see *Handling and Restraint*, page 2).

Controlling the Bleeding

Bleeding may be arterial (spurting bright red blood from the arteries) or venous (oozing dark red blood from the veins), and sometimes both. Do not wipe a wound that has stopped bleeding. This will dislodge the clot. Do not pour peroxide on a fresh wound. Bleeding will then be difficult to control. In addition, peroxide damages cells and prolongs wound healing.

The two methods used to control bleeding are the pressure dressing and the tourniquet.

Pressure Dressing

The most effective and safest method for controlling bleeding is to apply pressure directly to the wound. If the wound is on the leg, take several pieces of clean bandage material or sterile gauze, place them over the wound, and bandage snugly. Watch for swelling of the limb above and below the pressure dressing. Swelling indicates impaired circulation, in which case the bandage must be loosened or removed.

If material is not available for bandaging, or if the wound is on the body, place a pad on the wound and press firmly. Hold it in place for 15 minutes.

If blood soaks through the bandage or bleeding persists after the pad is removed, apply further pressure (or a tourniquet) and notify your veterinarian. An arterial bleeder may need to be tied off.

Tourniquet

A tourniquet may be required to control a spurting artery. Tourniquets can be used only on the legs and tail to control arterial bleeding that can't be controlled with a pressure dressing. *Tourniquets should never be used if bleeding can be controlled by direct pressure.* Always place the tourniquet above the wound (between the wound and the heart).

Vetwrap, a self-adhesive support wrap, makes a good tourniquet, is easy to apply, and will stay tight. In a life-threatening emergency, a suitable tourniquet can be made from a piece of cloth, belt, tire, or length of gauze. Loop it around the limb, then tighten it by hand or with a stick inserted beneath the loop. Twist the loop until the bleeding stops.

A tourniquet should be loosened every 10 minutes to prevent tissue *hypoxia* (damage due to lack of oxygen) and to check for persistent bleeding. If bleeding has stopped, apply a pressure bandage as described in the previous section. If bleeding continues, let the blood flow for 30 seconds and then retighten the tourniquet for another 10 minutes.

To make a pressure dressing, place sterile pads over the wound.

Cover the pads with gauze.

A stretch bandage helps to apply even pressure. It should not be pulled too tight.

Preventing Infection

Horses are more susceptible to tetanus than are most other domestic animals. Accordingly, all horses with wounds should receive tetanus prophylaxis. If the horse has been immunized against tetanus, he should be given a booster shot when he is wounded. If the vaccination history is unknown and the wound is either heavily contaminated or is a deep puncture wound (which is especially tetanus-prone), tetanus toxoid and tetanus *antitoxin* should be given in two different intramuscular locations. For a previously unvaccinated horse (or one whose status is not known), follow with a second tetanus booster in four weeks.

All wounds are contaminated with dirt and bacteria. Proper care will reduce the risk of tetanus and prevent some infections.

To treat extensive wounds and those requiring a cast, the horse will need to be chemically restrained using a local or regional anesthetic, and occasionally a general anesthetic. These wounds should be treated by a veterinarian. Cover the wound with a sterile dressing to prevent further contamination while awaiting veterinary instructions (see *Pressure Dressing*, page 33).

Wound Care

The five steps in wound care are skin preparation, cleansing, debridement, wound closure, and controlling infection.

Skin Preparation

Remove the original protective dressing and clean the area with a sterile surgical scrub solution. The two most commonly used solutions are povidone-iodine 10 percent (Betadine) and chlorhexidine diacetate 2 percent (Nolvasan). In the concentrations provided in the stock solutions, these preparations are irritating to unprotected tissue, so be sure to dilute them, following the manufacturer's recommendations. Scrub the skin around the wound but avoid contact with the open wound.

Then start at the edges of the wound and clip the hair back to prevent long hair from entering the wound.

Note that 3 percent hydrogen peroxide, often recommended as a wound cleanser, has little value as an antiseptic and is extremely toxic to tissues. Do not use it.

Cleansing

The purpose of cleansing is to remove dirt and bacteria. Vigorously scrubbing out a wound with a brush or gauze pad will further traumatize the wound and negate the benefits of cleansing. Wound *lavage* is a nontraumatic and a highly effective method of cleansing a wound. It involves irrigating the wound with copious amounts of irrigating fluid until the tissues are clean and glistening.

Tap water is a suitable and convenient lavage solution. Tap water has a negligible bacterial count and is known to cause less tissue irritation than sterile or distilled water. To provide antibacterial activity, add chlorhexidine or Betadine to the water. Studies show that chlorhexidine has the greater residual antibacterial effect, but either solution is satisfactory when correctly diluted.

To dilute chlorhexidine, add 25 ml of the 2 percent stock solution to 1 liter (about 1 quart) of water, for a 0.05 percent irrigating solution. To dilute povidone-iodine, add 10 ml of the 10 percent stock solution to 1 liter (about 1 quart) of water for a 0.1 percent irrigating solution.

The effectiveness of wound lavage is related to the volume and pressure of the fluid used. A bulb syringe is a low-pressure system and requires corre-

spondingly more fluid to achieve marginally satisfactory wound cleansing. A large syringe with a 19-gauge needle is sufficient to remove a moderate amount of dirt and bacteria. A plastic spray bottle will provide about the same pressure. A home Water-Pik unit (used by people) or a commercial lavage unit provide a high-pressure stream of fluid and are the most effective. A garden hose with a pressure nozzle would also work well as the initial water lavage, followed by one of the devices just mentioned to deliver the antiseptic surgical scrub.

Debridement

Debridement, which follows wound lavage, is the removal of devitalized tissue and any remaining foreign material using tissue forceps (tweezers) and a scalpel. Before starting, put on sterile surgical gloves and be sure all instruments are clean. Devitalized tissue and foreign matter are removed by scalpel dissection. Experience helps to determine the difference between normal and devitalized tissue, and to control bleeding that results from the scalpel dissection.

Wound Closure

The next decision is whether to close the wound or allow it to heal open. Wounds that are sutured and then become infected pose a serious risk of *sepsis*. Infections in open wounds, however, are far less troublesome.

Wounds that have been heavily contaminated are likely to become infected. These wounds should not be sutured. Similarly, wounds older than 12 hours should not be sutured. Suturing should not be done if there are signs

Debridement is the removal of devitalized tissue, which predisposes the wound to infection.

of inflammation in and around the wound, because this indicates impending infection.

Puncture wounds are quite likely to become infected. The external opening should be enlarged to provide drainage, after which the tract should be irrigated with a dilute antiseptic surgical scrub solution. Bites are heavily contaminated puncture wounds. With all animal bites, keep in mind the possibility of rabies. Puncture wounds should not be sutured. Administer tetanus prophylaxis, as described on page 63.

Fresh lacerations on the face are best sutured to prevent infection, minimize scarring, and speed recovery. Small lacerations may not need to be sutured. Lacerations on the leg usually cannot be closed because the skin is too tight and the sutures will pull through.

Occasionally, it is possible to close a wound that has been left open for several days and has developed a bed of clean granulation tissue. These wounds have acquired resistance to infection. Suturing such a wound is called a delayed primary closure.

The length of time that sutures should remain in depends on the location and other characteristics of the wound. Most sutures can be removed within 14 to 21 days, although some may be removed sooner. Follow your veterinarian's instructions.

Extensive, complicated wounds that must be left open should be cared for initially at a veterinary hospital. These wounds are likely to become infected and require intensive management, including daily lavage and debridement in many cases. Skin margins must grow together as open wounds heal, and it may take weeks or months for the skin to close.

Controlling Infection

Small open wounds can be treated at home. Medicate twice daily with a topical antibiotic such as triple antibiotic ointment. Recent evidence suggests that a steroid-antibiotic ointment (started after seven days) may increase the rate of skin closure. The horse should be confined to a clean stall until the surface of the wound has a protective scab. Restrict access to muddy paddocks and pastures until the wound is healed.

Infected wounds with a covering of *pus* will require moist sterile dressings. A number of topical antiseptics are effective in treating superficial wound infections. They include chlorhexidine and Betadine, diluted as described on page 35; furacin topical cream or solution 0.2 percent; silvadene cream 1 percent; and topical antibiotics containing bacitracin, neomycin sulfate, and polymyxin B sulfate. Apply directly to the wound or first place on a gauze pad. Change the dressings once or twice daily to aid in the drainage of pus. Seek immediate medical attention if the drainage is soaking the bandage more than once a day.

Oral and intramuscular antibiotics will not prevent wound infections but are indicated in the presence of *cellulitis* or *abscess* (see *Pyoderma*, page 123).

Most wounds on horses will heal with minimal scarring and a good functional result if the wound does not become infected and if it is protected from fly attacks. Flies seriously complicate the process of wound healing, promote infection, and cause the formation of excessive fibrous tissue in the wound. To protect the horse from flies and other biting insects, see *Controlling External Parasites* (page 63).

Granulation Tissue (Proud Flesh)

Part of the process that occurs during the healing of a wound is the formation of granulation tissue. When the skin surface has been cut, the defect must be filled in before the skin can regrow. Granulation tissue is how this is accomplished.

When the skin is cut, bleeding occurs and clots form. These blood clots reorganize into capillaries. This is the basis for the granulation tissue, but it is very fragile. Easily disrupted, it bleeds; new clots form and new capillaries are laid down on the original capillary bed. Once the skin defect has filled, the granulation tissue begins to contract, thereby reducing the size of the wound. Skin cells migrate over the surface of the granulation tissue to begin producing new skin.

A common condition in horses, proud flesh is an excess or overgrowth of granulation tissue. It is most often found on wounds below the knee or hock. Proud flesh makes it difficult for the skin cells to grow over the cut and often damages the new skin on the periphery of the wound. Proud flesh deteriorates the wound instead of healing it, and so must be discouraged.

Some outdated wound treatments, such as scarlet oil and gentian violet, actually promote and create more granulation tissue. Using bandages continuously may keep the wound site clean, but bandaging has been shown by studies to increase the amount of granulation tissue.

Treatment: If proud flesh production is suspected, seek veterinary advice for diagnosis and treatment. Treating exuberant granulation tissue is a complex issue and will vary from horse to horse.

Applying caustics, such as antimony trichloride, may have a place in treating some cases. Cases have also been treated by freezing the granulation tissue using liquid nitrogen or by applying probes placed in liquid nitrogen. Both the caustic chemicals and applied freezing techniques cause the death of the surface cells of the proud flesh, so their use requires skill and great care to not harm the growth of new skin. Once the proud flesh dies to a level below the surrounding new skin, the skin cells may then advance over the bed of remaining live granulation tissue.

The treatment that many veterinarians favor is surgical removal of the raised bed of exuberant granulation tissue. The portion of proud flesh that is above the adjoining skin level is carefully cut away, which allows the cells of the new skin to advance over the bed of granulation tissue.

Treatment may also involve advanced treatments such as skin grafts or laser treatments. Talk to your veterinarian to arrive at a treatment that is best for your horse.

Bandaging

Wounds may be bandaged or not, depending on their location. Wounds about the head are best left open to facilitate treatment. Many wounds of the upper body are difficult to bandage and do not benefit greatly from being covered. However, bandaging has the advantage of protecting a wound from dirt, manure, and fly attacks. It also restricts movement, compresses skin flaps, eliminates pockets of serum, and keeps the wound edges from pulling apart. Bandaging is most effective for extremity wounds. In fact, all leg and foot wounds should be bandaged.

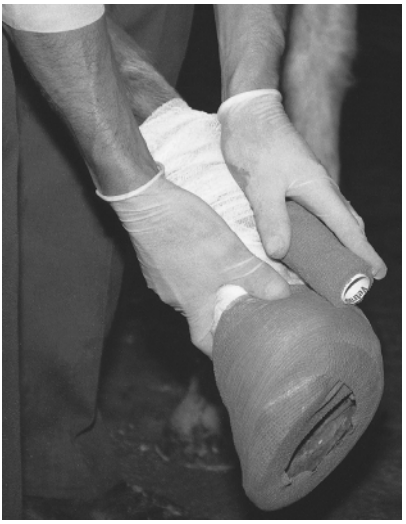
Unlike a temporary pressure dressing, a foot or leg bandage will remain for some time. It is important to pad the extremity well to prevent the bandage from becoming too tight and shutting off the circulation. Place several sterile Telfa pads over the wound and cover with one or more large pads to completely surround the leg. Wrap the whole thing with an elastic bandage, starting with the hoof and working up the leg. Be sure to overlap as you go. This prevents the skin from forming ridges and becoming pinched beneath the bandage. If this happens, the skin can become devitalized.

Do not cinch the wrap, but roll it around the leg without stretching the fabric. This will prevent the cumulative effect of an elastic bandage becoming too tight. Flex the joints beneath the bandage several times to ensure the bandage is secure, but not so tight as to interfere with the circulation. If there is doubt about the adequacy of circulation, loosen the bandage.

Bandages over clean, healing wounds can be changed every two to three days, but they should be inspected twice daily for signs of circulation problems, excessive pressure, limb swelling, slippage, drainage, or soiling. (If the bandage is soaked, bacteria can wick into the wound.) If any of these conditions are present, replace the bandage. Polyvinyl duct tape can be used to waterproof the bandage.

A draining or infected wound will need to be redressed at least daily. The bandage should be sufficiently bulky to absorb the drainage without soaking through. Disposable diapers can be used for bandages that incorporate the foot.

Foot and leg bandage. Cover the entire circumference of the leg with a soft pad and hold in place with a gauze roll.



Wrap from bottom to top with an elastic bandage, maintaining even tension without cinching the wrap.

The hoof should be included. This helps to immobilize the joints.

For foot wounds that require prolonged treatment, a protective boot or shoe with a removable treatment plate can be used. Wounds of the sole are discussed in *Foot Wounds* (page 210).