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Formidable Frostbite

Healthy horses handle frigid temperatures better than we do, but their extremities still are vulnerable to frostbite. The good news about frostbite in horses is that you'll rarely see it. But occasionally you'll notice the telltale signs that a horse has spent too much time in the frigid cold, maybe as a foal: his ear tips might be gone, or maybe even part of his tail. But horses, as a rule, handle cold temperatures better than humans do; the horse's body actually is better at conserving heat in cold weather than dissipating heat in hot weather. As days get shorter in the fall, the horse starts shedding summer hair and grows a longer, denser coat. As nighttime temperatures dip lower, he stores more fat under the skin—providing insulation against the cold and minimizing heat loss from the body. This means surface vessels that radiate heat in summer are deeper under the skin in winter.

Humans tend to freeze toes, fingers, and noses in severely cold weather, but horses rarely suffer frostbite. The horse's muzzle is richly supplied with blood and can withstand extreme cold without freezing. His feet and legs are designed in such a way that he can stand in deep snow without discomfort or damage. His slender legs are mainly bone and tendons below the knees and hocks, requiring less blood circulation than muscles. Thus, they are less susceptible to frostbite. Tissue cells in bones and tendons need less blood for maintenance than do muscles, and they also lose less heat.

The thick, dense hoof capsule (horny wall and sole) helps protect inner tissues of the foot. The horse is able to shunt most of the blood away from his feet and, yet, they are still very functional. When feet start to get cold, blood can flow from the smallest arteries directly into the veins, without having to pass through the smaller capillaries. The horse has developed this protective mechanism to keep his feet from freezing.

A horse's mane and tail also give protection. He instinctively turns his back to the wind, protecting his thin-skinned face and neck (which have more surface blood vessels). His rump and back have thicker skin and hair, fewer surface blood vessels, and can withstand the wind better than his front end. His tail protects delicate underparts, and his mane and forelock give insulating (and waterproof) protection for his head and neck. Horses in groups stand together to block the wind and also benefit from each other's body warmth.

Cid Hayden, DVM, of Salmon, Idaho, where winter temperature can drop to -30°F or colder, says horses usually do fine outdoors, even in severe weather. "They move around more than cattle and stay on their feet longer (not lying around chewing their cud), so they are less vulnerable to being chilled by lying on frozen ground.

Hypothermia

"If you find a near-frozen animal, such as a newborn foal, warming it up gently is usually recommended, not overdoing it with too much heat at once," says Katharina Lohmann, DVM, PhD, Dipl. ACVIM, of the Western College of Veterinary Medicine, in Saskatoon, Saskatchewan. "Bring it in, warm it up, and make sure it's dried off."

"Getting energy into the animal with proper nutrition (such as colostrum for a newborn) is also very important," she continues. "Severely hypothermic animals may require more intensive therapy, such as warmed IV (intravenous) fluids or warm oral fluids if they can tolerate the latter. It can sometimes be difficult to separate hypothermia from frostbite (you often see both problems together)." Take the animal's rectal temperature. If it's subnormal (less than 99.5°F), you need to be treating for hypothermia as well as potential frostbite.

"Rapid thaw at moderate temperatures (100-105°F, warm to the touch, but not hot) is often recommended," she says. "We use hot water bottles and heat lamps and closely monitor rectal temperature so the animal doesn't overheat. Overheating is potentially harmful for damaged skin." Hair dryers aren't recommended because it's difficult to know how much heat you are applying.

In a cold animal blood is concentrated in the body core (not the extremities), to try to keep internal organs warm enough to keep functioning.

Warming an animal too much, such as putting a very cold foal into hot water (hotter than 120°F, such as in a hot tub), can cause heat injury to the tissues, and it might be life-threatening in cases of severe hypothermia.

According to Ron Skinner, DVM, of Hall, Montana, doing this can also drive the cold from body surfaces into the core. If the heart is chilled too much (cold shock), it will stop, and the animal will suddenly die. Ranchers trying to thaw frozen calves in bathtubs have noted this. Instead, start with lukewarm water, gradually warming it to body temperature (101°F). Remember that humans whose temperatures are drastically lowered for surgery are brought back to normal very slowly.

A safe way to warm a severely cold foal is to administer warm IV fluids, apply warm water to the body surface, and warm the air the foal is breathing. It's important to warm the innermost part of the body as swiftly as you warm the outside, says Skinner. Occasionally, however, extreme cold or abnormal situations can lead to frostbite. In adult horses, usually the only sign of frostbite is loss of ear tips (which fall off about a week later). Foals born outside in cold weather are more adversely affected, since they are wet at birth and have very little body fat for insulation. If not found quickly and warmed up, foals will suffer from hypothermia as well as frostbite.

Hayden sees many more frozen ears, tails, and feet in calves than in foals, mainly because horses are seasonal breeders and most foals aren't born until spring or summer. "To have foals born in winter, you have to go to extreme lengths to manage the mares (with artificial lighting to stimulate estrous cycles) to breed them that early. Anyone who goes to that effort generally makes sure the foal is born indoors, with 24-hour watch on the mare," he says.

Frostbite Risks

Katharina Lohmann, DVM, PhD, Dipl. ACVIM, of the Western College of Veterinary Medicine, in Saskatoon, Saskatchewan, says even though winters can be quite cold in Saskatchewan, she hasn't seen very many cases of frostbite in horses. "In foals, you may see partial loss of ears and tails, and sometimes sloughing of the feet. Some animals in our area have lost the tips of their ears from frostbite," she says.

"The highest risk is in newborns," she notes. "If people breed mares early and a foal is born outside, it may suffer frostbite. Ranchers who calve early sometimes use little hats for newborn calves to protect their ears, but horse owners don't seem to use those for foals. She suspects that adult horses missing ear tips suffered frostbite as babies.

A newborn that doesn't get up and nurse right away is especially at risk for cold stress. That first crucial meal, colostrum, contains a high level of energy (twice the fat of regular milk); once he has nursed, this helps his body stay warm.

As mentioned previously, the adult horse's feet are remarkably able to tolerate cold. "Dr. Chris Pollitt did some work in his laminitis studies, using ice water on horses' feet for prevention of laminitis," says Lohmann. "This research involved implanting temperature sensors into the hoof walls and standing the horses in ice water. Although this cryotherapy (cold treatment) reduced hoof wall temperature considerably, there were no ill effects observed clinically. The horses tolerated the procedure very well, even if icing was continuous up to 48 hours. I'm not sure we can extrapolate these findings directly to horses living outside at 40 below zero, but it appears that their feet are quite tolerant to cold."

Hayden remembers a group of horses that suffered a little frostbite in their feet when it was -30°F for two weeks and they were standing in six inches of snow with no shelter. We found "a sheltered area (in some trees), scraping the snow away and piling straw on the ground," he says. "The horses were able to stand under the trees and have some protection for their feet."

A horse is healthiest on his feet, moving around. "Animals that are recumbent (unable to rise) for prolonged periods may be more at risk than a healthy horse," says Lohmann. "A sick, weak individual that spends a lot of time lying down may suffer frostbite more readily than a horse that's up moving around. We see this sometimes in cattle with severe arthritis, for instance. If they've become recumbent, they can become severely hypothermic (from lying on frozen ground) and can freeze to death."

An animal in poor body condition has less insulation against the cold (no fat stores) and can have impaired circulation. Lohmann emphasizes the importance of shelter and adequate nutrition for winter. Sick or dehydrated animals with compromised circulation are more at risk for frostbite because there's poor blood supply to the extremities. Any animal with severe diarrhea, for instance, is more vulnerable to having his ears, tail, and feet freeze.



Young foals and thin older horses are generally at risk because they have little fat reserve.

Photo: Photos.com

Young foals and thin older horses are generally at risk because they have little fat reserve. Other factors that increase risk for frostbite include temperature (with wind chill taken into consideration), length of time the animal is exposed to the cold, and moisture. If skin is wet and suddenly chilled (as with a newborn foal outdoors, a horse that falls through ice, or an animal wet from sweat or a storm, then exposed to dropping temperatures before he has a chance to dry), there's more risk.

Diagnosis and Treatment

In cases of frostbite, ice crystals form inside tissue cell membranes and the cells rupture and die. If it's just the superficial skin layers, those outer layers might become discolored then slough away (like a superficial burn), and the skin eventually heals because deeper layers are still alive. After healing, the skin might have loss of pigment. Damage to deeper layers and the small blood vessels in those layers leads to more extensive tissue death.

Hayden says signs of frostbite include tissue with no sensation (the animal can't feel a pin prick) and loss of skin flexibility. "Then it turns black," he says. "On a horse, you won't be able to see the blackness unless it's on an area of pink skin. The skin becomes hard and stiff, like leather, and eventually sloughs away." It can only heal by scarring if there's no viable skin left.

There's not much that can be done once tissue cells die. If you and your vet suspect frostbite and it's not too severe, you might treat the horse by warming the tissues. "We sometimes see animals people bring in because the legs and ears are swollen," says Lohmann. "We suspect they had frostbite that didn't quite kill the tissues." As blood returns to the tissues it creates edema (fluid swelling), redness, and inflammation.

There can be subcutaneous (beneath the skin) hemorrhage from damaged tissues. "According to a retrospective study of frostbite injuries in calves (1982-1991, published in 1993 in the *Canadian Veterinary Journal*, with references to other studies), edema after frostbite injury results from changes in vascular (blood vessel) permeability and impairment of fluid movement from the tissues," she says. "There's direct injury to blood vessels during freezing."

To diagnose a horse the veterinarian checks affected areas for sensation, assessing whether tissues are still alive, and for blood supply. "Often we check for sensation at the coronary band, sometimes sticking it with needles to see if it bleeds and whether the horse feels it," she says. "If they don't, that's usually indication that the tissue is dead. The only other thing I've seen that looks similar to frostbite was an animal with septic (toxic) vasculitis; it sloughed its hooves."

Vets have reported bone scans and vascular contrast studies as useful for assessing the degree of tissue damage. In the previously mentioned study the scientists said animals with painful limbs (lameness or pain response to palpation) probably have a better chance of tissue returning than those with nonpainful limbs (no sensation), relates Lohmann.

"The big question is how damaged are they?" she notes. "The differential diagnosis would be gangrene from something like ergotism." There are a number of plant toxins (such as those in smuts, which are parasitic fungal diseases affecting grasses, and ergot, the endophyte fungus that infects certain fescue grasses) that cause constriction of blood vessels near the body surface. This can interfere with circulation and increase a horse's chance of losing ears, tails, or feet. Anything that impairs circulation could put horses at greater risk for frostbite, even at temperatures that would ordinarily be no cause for concern.

As described earlier, tissue that's dead due to frostbite must slough away or be surgically removed. "If there's still some sensation or blood supply, the best treatment is just making sure the animal warms up, keeping it inside out of the cold until swelling has resolved (to keep impaired tissues from refreezing), and treating whatever else may be going on," says Lohmann. "Pain medication such as Bute or Banamine may be indicated, as well as antibiotics (topical or systemic) to prevent or treat infection in compromised tissues." Hayden starts patients he suspects have frostbite on such drugs immediately because of this infection risk. Vets also recommend tetanus vaccination, similar to what they'd advise for animals with other types of wounds.

Some horses might require sedation if thawing of the tissues proves painful. A horse experiencing pain from frostbite might shake his head (if his ears were frozen), paw, or bite at an affected area.

It's not advisable to rub frostbitten areas vigorously (in an attempt to restore circulation), as this can further damage compromised skin tissues. Apply warm wet towels or stand the animal in buckets of warm water if you are concerned about his feet.

Take-Home Message

While frostbite isn't common in horses, if you live in an area where your horses could be exposed to frigid temperatures for long stretches of time—especially if there's rain, ice, or snow—keep an eye out for the signs of frostbite. Provide shelter during severe weather. If you find your horse with any of the signs of frostbite, bring him in out of the cold and call your veterinarian.