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For Goodness Snakes!

Treating and Preventing Venomous Bites

By John Henkel

They fascinate. They repel.

Some pose a danger. Most are harmless.

And whether they are seen as slimy creatures or colorful curiosities, snakes play important environmental roles in the fragile ecosystems of the nation's wildlife areas.

People who frequent these wilderness spots, as well as those who camp, hike, picnic, or live in snake-inhabited areas, should be aware of potential dangers posed by venomous snakes. A bite from one of these, in which the snake may inject varying degrees of toxic venom, should always be considered a medical emergency, says the American Red Cross.

Every state but Maine, Alaska and Hawaii is home to at least one of 20 domestic poisonous snake species, according to a study in the August 1, 2002, issue of *The New England Journal of Medicine*. The article's authors estimate that between 7,000 and 8,000 people a year receive venomous bites in the United States, and about five of those people die. Some experts say that because people who are bitten can't always positively identify a snake, they should seek prompt care for any bite, though they may think the snake is nonpoisonous. Even a bite from a so-called "harmless" snake can cause an infection or allergic reaction in some individuals.

Medical professionals sometimes disagree about the best way to treat poisonous snakebites. Some physicians hold off on immediate treatment, opting for observation of the patient to gauge a bite's seriousness. Procedures such as fasciotomy, a surgical treatment of tissue around the bite, have some supporters. But most often, doctors turn to the antidote to snake venom--antivenin--as a reliable treatment for serious snakebites.

There are two types of antivenin (sometimes called "antivenom") in use today. They are derived from antibodies created in the blood of a horse or sheep when the animal is injected with snake venom. In humans, antivenin is injected either through the veins or into muscle, and it works by neutralizing snake venom that has entered the body. The first antivenin, derived from horse blood, was introduced in the United States in 1954. Because this antivenin is obtained from horses, snakebite victims who are sensitive to horse proteins must be carefully managed. The danger is that they could develop an adverse reaction or even a potentially fatal allergic condition called anaphylactic shock.

Newer kinds of antivenins derived from sheep have been studied, and one (CroFab) is now licensed for use in the United States. This sheep antibody preparation has been digested with an enzyme to reduce the risk of allergic reactions. The enzyme treatment also allows the antivenin to be cleared from the body more rapidly, so that additional treatments may need to be given.

The Food and Drug Administration regulates antivenins as part of its oversight of biological products. The agency requires certain criteria to be met before these materials are sold, including standards for purification, packaging and potency. The FDA also regulates antivenin labeling, ensuring that data on potential side effects and other pertinent information are available. The agency also periodically inspects antivenin production facilities to ensure compliance with regulations.

Types of Poisonous Snakes

Two families of venomous snakes are native to the United States. The vast majority are pit vipers, of the family Crotalidae, which include rattlesnakes, copperheads and cottonmouths (water moccasins). Pit vipers get their common name from a small "pit" between the eye and nostril that detects heat and allows the snake to sense prey at night. These snakes deliver venom through two fangs that the snake can retract at rest, but which spring into biting position rapidly. Virtually all of the venomous bites in this country are from pit vipers. Some--Mojave rattlesnakes or canebrake rattlesnakes, for example--carry a neurotoxic venom that can affect the brain or spinal cord. Copperheads, on the other hand, have a milder and less dangerous venom that sometimes may not require antivenin treatment.

The amount of venom actually delivered by a pit viper bite varies. "Some 20 to 30 percent of patients we see who have been bitten by a snake, who actually have fang marks, have not received any venom at all," says Edward L. Hall, M.D., a Thomasville, Ga., trauma surgeon who treats snakebites." He says one reason for this may be poor timing by the snake. "Pit vipers have a very sophisticated mechanism that allows them to deliver venom at the exact instant the teeth are sunk into the flesh. So it has to be precise timing. But what we often see is that the [snake's timing is off and] venom is squirted on the pants leg

or released prematurely."

The other family of domestic poisonous snakes is Elapidae, which includes two species of coral snakes found chiefly in the Southern states. Related to the much more dangerous Asian cobras and kraits, coral snakes have small mouths and short teeth, which give them a less efficient venom delivery than pit vipers. People bitten by coral snakes lack the characteristic fang marks of pit vipers, sometimes making the bite hard to detect.

Though coral snakebites are rare in the United States--only about 25 a year by some estimates--the snake's neurotoxic venom can be dangerous. A 1987 study in the *Journal of the American Medical Association* examined 39 victims of coral snakebites. There were no deaths, but several victims experienced respiratory paralysis, one of the hazards of neurotoxic venom.

Some nonpoisonous snakes, such as the scarlet king snake, mimic the bright red, yellow and black coloration of the coral snake. This potential for confusion underscores the importance of seeking care for any snakebite (unless positive identification of a nonpoisonous snake can be made).

The bites of both pit vipers and coral snakes can be effectively treated with antivenin. But other factors, such as time elapsed since being bitten and care taken before arriving at the hospital, also are critical.

First Aid for Snakebites

Over the years, snakebite victims have been exposed to all kinds of slicing, freezing and squeezing as stopgap measures before receiving medical care. Some of these approaches, like cutting into a bite and attempting to suck out the venom, have largely fallen out of favor.

"In the past five or 10 years, there's been a backing off in first aid from really invasive things like making incisions," says Arizona physician David Hardy, M.D., who studies snakebite epidemiology. "This is because we now know these things can do harm and we don't know if they really change the outcome."

Many health-care professionals embrace just a few basic first-aid techniques. According to the American Red Cross, these steps should be taken:

- Wash the bite with soap and water.
- Immobilize the bitten area and keep it lower than the heart.
- Get medical help.

"The main thing is to get to a hospital and don't delay," says Hardy. "Most bites don't occur in real isolated situations, so it is feasible to get prompt [medical care]." He describes cases in Arizona where people have caught rattlesnakes for sport and gotten bitten. "They waited until they couldn't stand the pain anymore and finally went to the hospital after the venom had been in there a few hours. But by then, they'd lost an opportunity for [effective treatment]," which increased the odds of long-term complications. Some medical professionals, along with the American Red Cross, cautiously recommend two other measures:

- If a victim is unable to reach medical care within 30 minutes, a bandage, wrapped two to four inches above the bite, may help slow venom. The bandage should not cut off blood flow from a vein or artery. A good rule of thumb is to make the band loose enough that a finger can slip under it.
- A suction device may be placed over the bite to help draw venom out of the wound without making cuts. Suction instruments often are included in commercial snakebite kits.

Treatment Drawbacks

Antivenins have been in use for decades and are the only effective treatment for some bites. "Antivenins have a fairly good safety record," according to Don Tankersley, former deputy director of the FDA's Division of Hematology. "There are sometimes reactions to them, even life-threatening reactions, but then you're treating a life-threatening situation. It's clearly a case of weighing the risks versus the benefits."

People previously treated with horse-derived antivenin for snakebites probably will develop a lifelong sensitivity to horse products. To identify these and other sensitive patients, hospitals typically obtain a record of the victim's experience with snakebites or horse products. But some people with no history of such exposures may have become sensitive through contact with horses, or possibly through exposure to horse dander, and be unaware that they are sensitive. Others may be sensitive without any known or remembered contact with horses. So hospitals also perform a skin test that may quickly show any sensitivity. However, the test also can give a false-positive or false-negative skin reaction. Some hypersensitive patients may even have severe reactions to the small amount of antivenin used in the skin test. Hospitals usually treat patients with serious allergic reactions by administering epinephrine. Some victims with positive skin tests can be desensitized by gradually administering small amounts of antivenin.

Certain venomous snakebites may be treated without using antivenin. This is usually a judgment call the doctor makes based on the snake's size and other factors, which normally involves close monitoring of patients in a medical facility.

"In some areas, such as desert areas, most rattlesnakes are small and don't have as potent a venom," says Hall. "You might get by with those patients in not using antivenin." But with other snakes, Hall says, antivenin can be a lifesaver. For example, the Eastern diamondback rattlesnake--found in large numbers in the region of Georgia where Hall practices medicine and in other Southern states from the Carolinas to Louisiana--can reach six feet in length and deliver a potent payload of venom. "It's an enormously dangerous bite that requires very aggressive treatment [with antivenin] or the patient will die," Hall says.

Treatment Dilemmas

Because not all snakebites, including those from the same species, are equally dangerous, doctors sometimes face a dilemma over whether or not to administer antivenin. Venomous snakes, even dangerous ones like the Eastern diamondback, don't always release venom when they bite. Other snakes may release too small an amount to pose a hazard.

Another complicating factor is the diverse potency of venom. "Venom can vary within species and even within litter mates--brothers and sisters," says Arizona physician Hardy. For example, he says, a common pit viper in the Southwest, the Mojave rattlesnake, may carry a powerful neurotoxic venom in some areas and a less toxic one in others.

Hall's work in Georgia and Florida shows that factors such as genetic differences among snakes, their age, nutritional status, and the time of year also can affect venom potency. All these variables make it nearly impossible for doctors to characterize a "typical" venomous snakebite. That's why there exists what Hall calls "so much controversy" about snakebite treatment.

The solution, Hall says, lies with the patient. "Truly the only way to look at snakebites is on an individual basis and on the patient's actual reaction to the venom." Basic signs like pain, swelling and bleeding, along with more complicated reactions such as ecchymosis (purple discoloration), necrosis (tissue dies and turns black), low blood pressure, and tingling of lips and tongue give medical professionals clues to the seriousness of bites and what treatment route they should take.

Some experts emphasize that, although antivenin can effectively reverse the effects of venom and save life and limb, there is no guarantee that it can reverse damage already done, such as tissue necrosis. Some patients may later require skin grafts or other treatment. Arizona physician Hardy says the potential for limiting complications is one compelling reason to seek medical treatment as soon as possible after a snakebite.

Avoiding Snakebites

Some bites, such as those inflicted when snakes are accidentally stepped on or encountered in wilderness settings, are nearly impossible to prevent. But experts say a few precautions can lower the risk of being bitten:

- Leave snakes alone. Many people are bitten because they try to kill a snake or get a closer look at it.
- Stay out of tall grass unless you wear thick leather boots, and remain on hiking paths as much as possible.
- Keep hands and feet out of areas you can't see. Don't pick up rocks or firewood unless you are out of a snake's striking distance. (A snake can strike half its length, Hardy says.)
- Be cautious and alert when climbing rocks.

What do you do if you encounter a snake when hiking or picnicking? Says Hardy: "Just walk around the snake, giving it a little berth--six feet is plenty. But leave it alone and don't try to catch it."

Though poisonous snakes can be dangerous, snake venom may have a positive side. Clinical trials reported in the February 2002 issue of the *Journal of Evaluation in Clinical Practice* indicate that a venom-derived product called ancrod could provide significant benefits in treating stroke. Earlier proposals using snake venom to treat neuromuscular disorders such as multiple sclerosis never reached the clinical trial stage.

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How NOT to Treat a Snakebite

Though US medical professionals may not agree on every aspect of what to do for snakebite first aid, they are nearly unanimous in their views of what not to do. Among their recommendations:

- No ice or any other type of cooling on the bite. Research has shown this to be potentially harmful.
- No tourniquets. This cuts blood flow completely and may result in loss of the affected limb.
- No electric shock. This method is under study and has yet to be proven effective. It could harm the victim.
- No incisions in the wound. Such measures have not been proven useful and may cause further injury.

--J.H.

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