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Rattlesnake Bites in California

A venomous animal is one with specialized glands that secrete a toxic substance which immobilizes and then kills prey. Spiders, insects, and snakes are venomous animals with snakes being particularly deadly.

There are five types of venomous snakes:

- *Colubridae* – These snakes possess rigid rear fangs in their mouths. An example would be the boomslang (an African tree snake)
- *Elapidae* – These snakes possess rigid front fangs in their mouths. Examples would be the cobra, mamba, and coral snake.
- *Viperidae* – These snakes have hinged front fangs. The adder and asp are examples.
- *Crotalines* – These snakes also have hinged front fangs and are the subject of our discussion. These include the copperheads and rattlesnakes.
- *Hydrophiidae* – These have rigid front fangs and are completely aquatic. These are the sea snakes.

The snakes with rigid fangs bite and hold their prey until it dies. The snakes with hinged fangs, such as the rattlers, will strike, release the prey, and then look for the dead body.

Snake venom is highly complicated. At least 26 separate enzymes have been identified but some 10 enzymes appear common to all snake venoms (though in different concentrations). All snake bites are not equal. The quality of venom depends not only on the type of snake but on the season, the geographical region, the age of the snake, and how recently it has released venom previously.

California Rattlesnakes

The only venomous snakes in California are the rattlesnakes, and there are eight species:

The Western Rattlesnake (*Crotalus viridis*) – This snake species has been divided up into numerous subspecies and DNA analysis is showing that these may actually be separate species. There are currently 7 subtypes of *Crotalus viri*dis and three are native to California (these three pictures thanks to California Reptiles and Amphibians at www.californiaherps.com):

Crotalus viridis halleri (the Southern Pacific Rattlesnake), *Crotalus viridis luto*sus (The Great Basin Rattlesnake), and *Crotalus viridis oreganus* (the Northern Pacific Rattlesnake)

Southern Pacific

Northern Pacific

Great Basin

(The following five pictures thanks to *Biology of the Rattlesnake Symposium* at Loma Linda University at: www.roblee.com/rattlesnakes)

The Western Diamondback *(Crotalus atrox)*

The Red Diamondback *(Crotalus ruber)*

The Sidewinder *(Crotalus Cerastes)*

The Speckled Rattlesnake *(Crotalus mitchellii)*

The Mojave Rattlesnake *(Crotalus scutalatus)*, sometimes called the Mojave Green Rattlesnake)

The physical appearance of each snake species is variable and it is difficult to tell what species of snake one is looking at. Some general principles in distinguishing poisonous snakes are:

• Broad, triangular head with a noticeable "neck" behind the head.
• Vertical pupils (non-poisonous snakes have round pupils) though hopefully one would not be close enough to evaluate this.
• The Crotalines are also called "pit vipers" because they have heat-sensing "pits" on their faces between the eye and nostril. The pits help them locate prey.

Rattlesnakes can be found in rural areas as well as suburban areas where there is sufficient natural habitat. In Northern California snakes will hibernate during cold months and are active March through September. In Southern California they are active all year round.

Dogs vs. Snakes

Dogs encounter snakes during play or work in the snake's natural habitat. Most bites to dogs occur on the face or extremities. The rattlesnake bite is generally hemotoxic, which means that it exerts its toxin by disrupting the integrity of the blood vessels. The swelling is often dramatic with up to 1/3 of the total blood circulation being lost into the tissues in a matter of hours. The toxin further disrupts normal blood clotting mechanisms leading to uncontrolled bleeding. This kind of blood loss induces shock and finally death. Facial bites are often more lethal as the swelling may occlude the throat or impair ability to breathe.

An exception would be the Mojave rattlesnake whose venom is neurotoxic. The bite of this snake causes rapid paralysis. This includes paralysis of the respiratory muscles and suffocation.

How serious a snake bite is depends on several factors:

- The species of snake
- The size of the dog
- The amount of venom injected (approximately 20% to 25% of bites are "dry," meaning no venom has been injected; 30% of bites are mild, meaning they cause local pain and swelling in the bite area and no systemic symptoms; 40% of bites are severe with approximately 5% being fatal).

Treatment

The faster the bite is recognized, the more effective the treatment is. Do not try to cut the bite wound open or suck out the poison. Seek veterinary care immediately for proper treatment.

IV Fluids

Since the most common mechanism of death from rattlesnake bite is circulatory collapse, IV support and monitoring for signs of blood pressure drop are very important. Fluids may be started at a relatively slow rate if the patient is stable but should signs of impending trouble occur, circulatory volume replacement is as easy as opening a drip set valve. Twenty four hours of observation post-bite is a prudent observation time with IV fluid administration all the while.

Antivenin

There are numerous misconceptions about antivenin. The first is simply the name of the product. It is not "anti-venom." It is not a single injection that provides the antidote to snake bite venom. Antivenin is a biological product consisting of antibodies made by horses in response to exposure to four common Crotaline venoms. The antibody serum is reconstituted into an intravenous drip that is run into the patient over at least 30 minutes or so.

Antivenin is expensive (at least $100 to $200 per vial) and a large dog with a severe bite is likely to require several vials. Because the product if of horse origin, often a scratch test to the ear flap is used to test for immunological sensitivity (i.e. to predict whether the patient is likely to have anaphylactic reaction to the antivenin once it is administered intravenously. The patient will likely always be sensitive to equine products after administration of antivenin which makes future snake bite treatment problematic.

A newer, more purified antivenin of sheep origin has recently been marketed ("Cro-Fab" antivenin) but this is even more expensive (approximately $700 per vial).

Antivenin is very helpful in the inactivation of snake venom but there is a narrow window during which it must be used. After about 4 hours post-bite, antivenin is of minimal use.

A separate antivenin is available for coral snake venom but this is not an issue for California.

Antihistamines

Injections of antihistamines may or may not be helpful with the inflammation from the actual snake bite but may be helpful in warding off anaphylactic reaction to the antivenin. Further, the sedating side effects of antihistamines help calm the patient. Antihistamine use is a common therapy used in the treatment of snake bites.

Corticosteroids seem like they would be helpful as they are universally anti-inflammatory; however, their use has been associated with higher mortality rates so they are not generally administered.

Other Treatments

Blood transfusion may be necessary if life-threatening blood loss has occurred. Antibiotics are often used to control secondary infections. Medications to control pain are important to snake bite patients.

Vaccination

Recently, Red Rock Biologics has released a vaccination against the venom of the Western Diamondback (*Crotalus atrox*). This vaccine also protects against the venom of six out of seven of the other California rattlesnakes (the Mojave Rattlesnake has such significantly different venom that it is not covered) and there is good cross-protection against numerous other venomous snakes native to areas outside California. At first this product was available for sale and use only in California; but it has become available nationwide since December of 2004. Hiking dogs and dogs

that live in rattlesnake areas are good candidates for this product.

Basics About the Vaccine

- Initial vaccination is given in 2 doses 3 to 6 weeks apart. Dogs over 100 lbs and dogs under 30 lbs in body weight need 3 doses 3 to 6 weeks apart.
- Annual boosters are best given approximately one month before snake season starts in the spring. Dogs who live where snake season is year round or where they hike year round should have boosters every 6 months. If a vaccine is skipped, the initial vaccination protocol should be re-started.
- Vaccination is safe during pregnancy and lactation, and for puppies 4 months of age and older.
- Vaccination reactions occur in 0.27% of cases (27 per 10,000 doses given) and are largely limited to swelling at the vaccine site occurring 7 to 10 days after vaccination. This is particularly true for dogs with a past history of bee stings.
- Vaccinated dogs typically develop protection comparable to 2 to 3 vials of antivenin.

A snake bite should always be treated as an emergency, even in a vaccinated dog.

If your dog is bitten by a rattlesnake, seek veterinary attention immediately.

The FDA has a rattlesnake bite prevention information for humans at http://www.fda.gov/fdac/features/995_snakes.html

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