

Envenomations: Or, All that Bites Doesn't Slither

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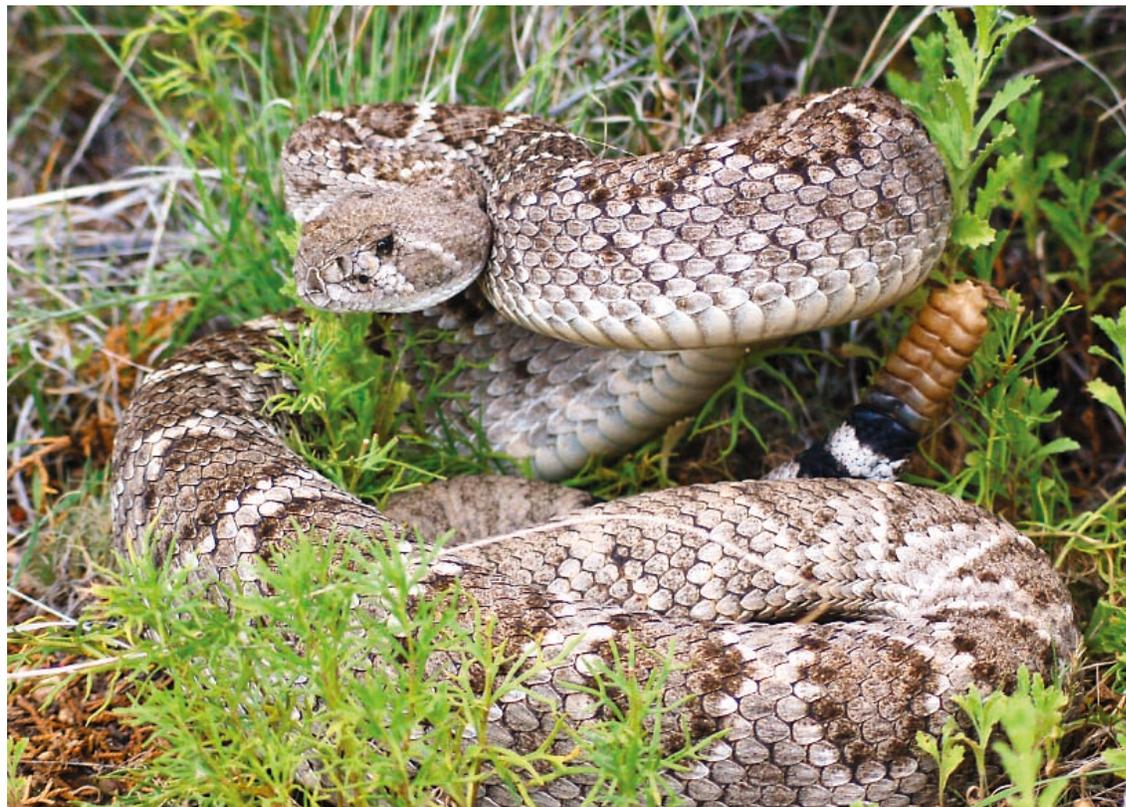


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Objectives

At the end of the CE module, the EMS provider will be able to:

1. Identify venomous animals commonly found in Texas.
2. Identify the mechanisms by which venom works.
3. Explain what prehospital treatments may benefit a patient who has been bitten by a poisonous animal.

Introduction

As many EMS providers (as well as the public) know, the outdoors of Texas are filled with all sorts of animals, some of which are simply annoying, such as mosquitoes. Other animals have the ability to produce venom either for hunting or self-defense. The vast majority of these venomous animals are also mere annoyances, but a few present medical complications that Texas EMS providers may encounter.

In Texas, envenomations are typically an annoyance that can be most commonly treated with first aid and without contacting EMS. The envenomations that could require EMS interventions are snakebites, with the occasional possibility, depending on location, of some spider bites and marine animal bites. However, even in “minor” bites (for example, bee stings and

fire ant envenomations), there remains the possibility that a person may experience an allergic or anaphylactic reaction to the bite, necessitating EMS intervention. In those cases, the standard treatment protocols for allergic/anaphylactic reactions usually apply.

Spiders

Texas has two venomous spiders that have the potential to cause serious complications in humans. One is the brown recluse spider (*Loxosceles reclusa*). The other poisonous spider endemic to Texas is the Southern black widow spider (*Latrodectus mactans*).¹

The Southern black widow is the better known of these two spiders. A relatively shy spider, it is most commonly found in protected areas outdoors. The female of the species is the most usual to bite,



especially when defending its egg sac. The typical female Southern black widow is approximately one and a half inches long with a red hourglass-shaped marking on its abdomen. The males of the species tend to be approximately half the size of the females.²



The Southern black widow spider produces a neurotoxin. This neurotoxin produces pain associated with muscle cramping. The neurotoxin's effects on the autonomic nervous system include nausea, vomiting, sweating, hypertension, tachycardia and occasionally priapism.³ These symptoms usually persist for 36 to 72 hours after the bite. The bite is typically identified by a "target" lesion occurring within 30 to 120 minutes after the bite.⁴

Prehospital treatment for black widow bites is primarily supportive in nature, focusing on analgesia for pain management as well as benzodiazepines to lessen the effects of the muscle cramping as well as to reduce the anxiety associated with the pain. Some sources also suggest administration of calcium gluconate for the relief of the cramping, although this is not a universal recommendation. In the hospital setting, an antivenin for black widow spider venom is available.⁵

Brown recluse spiders are commonly known as a "fiddle-back," referencing the violin-shaped marking on the top of the head. The spider is typically 1/4 to 3/4 inch long, with a leg span approximately the size of a quarter or half dollar. It is most commonly found in dark, secluded places where there is little activity.⁶

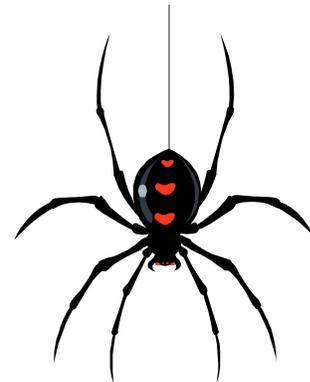


The brown recluse's venom is a mix of cytotoxins (poisons affecting cells) than can lead to necrotic tissue damage. The initial bite shows as a small blister that may be surrounded by a white halo. Over the next 24 hours, the bite produces localized swelling, pain and redness. Over the next few weeks, localized tissue necrosis is possible. Symptoms of brown recluse envenomation include malaise, chills, fever, nausea, vomiting and joint pain. Severe cases may progress to life-threatening bleeding disorders, including disseminated intravascular coagulation and hemolytic anemia.⁷

Prehospital treatment includes cleaning the wound and applying a cold compress to the bite. The current Advanced Medical Life Support (AMLS) curriculum recommends Fentanyl for pain management as Fentanyl does not produce the histamine release associated with other opiates.⁸ Hospital treatment is described as "benign neglect," focusing if necessary on wound care and treatment of systemic reactions. An experimental antivenin has been used in research, but is not commercially available.⁹

Snakes

Texas has two main families of poisonous snakes: pit vipers (crotalids) and coral snakes. The pit vipers include the various species of rattlesnakes, water moccasins (cottonmouths) and copperheads. Pit vipers are commonly identified by their large head, which is described by many as arrow or diamond shaped. Additionally, pit vipers have heat sensing pits on the head, giving them their name. Pit vipers have elliptical eyes and retractable fangs. Coral snakes are banded with red, yellow and black bands. Coral snakes can be differentiated from



similar-looking snakes, such as king, milk or scarlet snakes, by using an old rhyme, “Red against yellow kills a fellow. Red against black, poison lack.” Coral snakes have a head that is the same size as the rest of its body, round eyes and small fangs fixed to the rear of the mouth.¹⁰

Texas has about ten different rattlesnakes. These include the pigmy rattlesnake (*Sistrurus miliarius*), timber rattlesnake (*Crotalus horridus*), massasagua (*Sistrurus catenatus*), Mojave rattlesnake (*Crotalus scutulatus*), black tail rattlesnake (*Crotalus molossus*), Western diamondback rattlesnake (*Crotalus atrox*), mottled rock rattlesnake (*Crotalus lepidus*), banded rock rattlesnake (*Crotalus lepidus klauberi*) and the prairie rattlesnake (*Crotalus viridis*). Rattlesnakes look like the classic description of a pit viper, with the addition of a rattle on the tail. The colors of a rattlesnake will vary, especially between species of rattlesnakes. Typically, these snakes will use the rattle as a warning prior to defensive striking.

Copperheads in Texas include the broadband copperhead (*Agkistrodon contortrix laticinctus*) and the southern copperhead (*Agkistrodon contortrix contortrix*), which are found throughout the state. The trans-Pecos copperhead (*Agkistrodon contortrix pictigaster*) is found only in the Big Bend region of Texas. Copperheads are recognized by their copper-colored head and body. The copperhead’s body is marked with bands of darker brown in somewhat of an hourglass pattern.

Water moccasins (*Agkistrodon piscivorus*) are found near freshwater and the surrounding environment. They are noted for being aggressive and are

quick to bite to defend their territory. The water moccasin is characterized by a dark brown, olive or blackish body with a lighter belly. The underbelly may be mottled with dark areas. The mouth is frequently displayed in an open position, exposing the white inner surface, and from which it derives its nickname: cottonmouth.¹¹



Crotalid (pit viper) venom is primarily a hemotoxin with some cytotoxic and neurotoxic properties. The neurotoxic properties are primarily found in the Mojave rattlesnake. The venom serves not only as a poison to neutralize the prey but also contains enzymes to begin the digestive process before the snake even begins to eat the prey. As a result of the hemotoxins, cytotoxins and digestive enzymes, tissue damage and necrosis present a very real danger in any pit viper envenomation. The venom causes localized tissue injury, systemic vascular damage, hemolysis, fibrinolysis and, potentially, neuromuscular dysfunction.

Crotalid venom also causes loss of plasma and blood into the surrounding tissue due to its alterations of blood vessel permeability, leading to hypovolemia. Because of crotalid venom’s consumption of fibrinogen and platelets, coagulopathy (loss of blood clotting) may occur. Clinically, a crotalid envenomation may be identified in three ways: localized injury (swelling, pain and bruising); blood chemistry abnormalities; or systemic effects such as oral swelling, a metallic or rubbery taste in the mouth, hypotension or tachycardia. In extreme cases, the coagulopathy and blood



vessel permeability changes may lead to compartment syndrome.¹² Compartment syndrome is the compression of nerves, blood vessels and muscle inside a closed space within the body. In extreme cases of compartment syndrome, emergent surgical intervention is required. For this reason, some EMS systems consider pit viper bites to require transport to a trauma center.¹³

Current literature recommends the following prehospital treatment by EMS providers: immobilization of the affected limb and the application of a constricting band to delay the spread of the venom. Administration of intravenous fluids and oxygen is also recommended to counteract the hypovolemic effects of the venom. Previously accepted therapies such as cold therapy, tourniquets, cutting to remove the venom, suctioning the venom, and electrical therapy are now specifically contraindicated. The primary therapy in the hospital setting is the administration of antivenin. The current crotalid antivenin available in the United States is called Crotalid Polyvalent Immune Fab, or FabAV. The antivenin is made through exposing sheep to certain pit viper venoms and harvesting the antibodies. Initially, four to six vials of FabAV are administered to the patient to control the symptoms, then two vial doses are recommended for maintenance treatment.¹⁴

Coral snakes are found in the elapid family, the same family as the cobras. In fact, coral snakes are the only elapids found in the Western Hemisphere. The Texas Coral Snake (*Micrurus fulvius tener*) is the primary coral snake encountered in Texas. Due to their docile nature and poorly developed fangs, which require chewing on the skin to inject venom, coral snake envenomations are quite rare. The neurotoxic effects may take 12 to

24 hours to appear in a patient. These symptoms include weakness, drowsiness, slurred speech, ataxia, paralysis of the larynx or tongue, drooping eyelids, dilated pupils, abdominal pain, nausea, vomiting, seizures, respiratory distress and hypotension. Prehospital management includes immobilization of the affected extremity, application of a constricting band and administration of intravenous fluids. Due to the neurotoxin's possible effect on the patient's respiratory status, EMS providers should be prepared to provide ventilator support for these patients.¹⁵ In the hospital, the primary therapy is coral snake antivenin, which is normally initially administered in three to five doses.¹⁶

Marine animals

The Texas Gulf Coast has two marine animals associated with serious envenomations—the Portuguese Man-O-War (*Physalia physalis*) and various forms of the stingray. The Portuguese Man-O-War, similar to a jellyfish, has long stinging cells called nematocysts. A patient stung by these nematocysts typically experiences localized pain and swelling. In extreme cases though, the patient may experience a severe backache, an inability to move, or respiratory difficulties.¹⁷ If a person is stung while swimming, the difficulty in moving may cause the patient to drown. Currently recommended prehospital therapies include pain management, antihistamines and placing the affected area of the body in warm water.¹⁸

Stingray envenomations occur



when a person is struck by the stingray's tail, whose underlying barb or stinger releases venom. In the case of divers, the tail can also cause severe intrathoracic or intraabdominal trauma. As with many marine animals' venom, stingray venom is heat labile, meaning it can be neutralized by heat. Treatment for stingray poisoning usually includes heat therapy and pain management if necessary. Surgical intervention and/or antibiotics may be required, particularly if any of the barbs from the tail remain embedded in the patient.¹⁹

Anaphylaxis

As a refresher, it should be noted that allergic reactions are often associated with envenomations from other animals, particularly bees, wasps, and yellow jackets. Anaphylaxis is a life-threatening condition requiring time-sensitive intervention. Signs and symptoms of anaphylaxis include hypotension, tachycardia, respiratory difficulty, wheezing, anxiety, angioedema (swelling of the tongue), urticaria (hives) and pruritus (itching). When assessing a patient with an envenomation, anaphylaxis should be immediately considered as a possible differential diagnosis. Epinephrine is used to treat anaphylaxis due to its effect on both alpha and beta receptors, which both raises blood pressure and increases bronchodilation. Diphenhydramine (Benadryl) is administered to bind and block the histamine receptors. Additionally, inhaled beta agonists such as Albuterol may be utilized to promote bronchodilation. Intravenous fluid boluses may be administered to counteract the hypotension associated with anaphylaxis. Further, intravenous steroids may be

administered to provide long-term relief of bronchospasms and angioedema.²⁰ Due to the bronchial constriction and laryngospasm associated with anaphylaxis, endotracheal intubation may be difficult, especially in visualizing the glottic opening. As such, the use of a bougie to facilitate intubation through its smaller size and ability to feel the tracheal rings may be warranted.²¹

Conclusion

For many EMS providers, encounters with poisonous animal envenomations are a rare occurrence. However, through proper assessment and use of current treatment modalities, the outcome for the vast majority of patients is typically positive. For additional information regarding venomous animals, EMS providers can also use the Texas Poison Control network as a resource. They may be contacted at any time via telephone at 800-222-1222 or online at www.poisoncontrol.org.

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