

Envenomations: An Overview of Clinical Toxicology for the Primary Care Physician

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About 4,000 to 6,000 venomous snakebites occur each year in the United States. Although these envenomations (also known as envenomings) are rarely fatal, about 70 percent require antivenom therapy. Few evidence-based guidelines are available for the management of envenomation. Antivenom therapy is the cornerstone of management for hemorrhagic or coagulopathic envenomation from pit vipers (with or without paralytic features), and for paralytic envenomation from coral snakes. Early intubation and ventilation may be required after bites from pit vipers whose venoms contain presynaptic neurotoxins. Although relatively controversial, antivenom therapy seems to be effective for the management of severe envenomation from widow spiders. Conversely, little evidence supports any specific management strategy for necrotic envenomation from recluse spiders. Cytotoxic fish stings, cnidarian stings, and traumatic penetrative envenomation by stingrays are typically managed symptomatically. Private collection of nonnative venomous animals in the United States is another source of medical risk. (*Am Fam Physician*. 2009;80(8):793-802. Copyright © 2009 American Academy of Family Physicians.)



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Venomous animals have evolved venoms and delivery apparatus to assist in prey acquisition and defense against predators.¹ An understanding of the risks to humans from exposure to these venoms is based on an appreciation of how the toxins have evolved to work against intended prey. Clinical toxicology, a subspecialty of medical toxicology, addresses the clinical effects, diagnosis, and treatment of diseases caused by injection (by bite or sting) or ingestion of toxins produced by animals or plants.

Most envenomations in the United States are caused by local fauna. However, the growing trade and private collection of exotic venomous animals, such as snakes, fish, scorpions, and spiders, has complicated this situation. The occasional introduction of nonnative species into the environment may

result in additional risk. A classic example is fire ants (*Solenopsis invicta*), which are now established in the southeastern and south-central United States. *Online Table A* lists  some representative medically important venomous animals that are native to North America. Details on every venomous animal in North America are beyond the scope of this article, but additional information has been published¹⁻⁴ and is available online.

Epidemiology

Snakes are responsible for most envenomations. Globally, an estimated 1.2 million persons are bitten by snakes each year; hundreds of thousands of these persons have long-term injury, and 20,000 to 100,000 die.⁵ Of the 4,000 to 6,000 venomous snakebites that occur each year in the United States, approximately 70 percent require antivenom

SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendation</i>	<i>Purpose</i>	<i>Evidence rating</i>	<i>References</i>	<i>Comments</i>
Hot water immersion should be used for first aid and treatment of cnidarian (jellyfish) stings.	Analgesia	B	23, 24	Randomized controlled study using 113°F (45°C) water immersion for first aid and treatment of stings from Portuguese man-of-war (<i>Physalia physalis</i>)
Antivenom should be administered to patients with systemic symptoms from black widow spider bites.	Relief of symptoms, analgesia	B	25, 26	Review of case series and additional patient-oriented evidence
Pressure and immobilization should be used as first aid for elapid snakebites.	Delay of systemic absorption of venom from bite site	C	27, 28	Anecdotal clinical observations, some case histories and animal models (with limited number of subjects); technique is still controversial
Skin sensitivity testing should not be performed before administration of antivenom.	Testing has no proven value and carries potential risk	C	28, 41, 42	Opinion from worldwide consensus and a retrospective review of 254 cases
Antihistamines should not be given before administration of antivenom.	Antihistamines do not prevent acute adverse reactions to antivenom	C	9	Synthesis of data from two trials (one randomized, one quasirandomized) involving a total of 206 patients
Dapsone, steroids, antihistamines, and hyperbaric oxygen therapy should not be used to treat envenomation from brown recluse spiders (<i>Loxosceles reclusa</i>).	Ineffective treatments for recluse spider envenomation	C	10-12	Prospective and controlled trials of treatment modalities in rabbits

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/afpsort.xml>.

therapy,⁶ and about five are fatal.⁷ This is far less than the estimated 40 to 100 persons who die each year from anaphylaxis after hymenopteran stings.⁸

It is important to note that not all bites by venomous species cause clinical effects. For example, pit vipers may inflict “dry” bites (i.e., without injection of venom). Furthermore, most snakes in the United States are nonvenomous or only mildly toxic colubrid species, and these snakes are responsible for most bites. Familiarity with the local snake fauna and prompt consultation with a toxinologist or herpetologist may allow for early discharge of patients bitten by nonvenomous species. Serious envenomations from nonnative snakes occasionally occur, as do injuries and envenomations inflicted by nonnative fish, centipedes, spiders, and other exotic animals (*Online Table B*).

Diagnosis

The key starting point in managing a definite or suspected envenomation is establishing the diagnosis. This includes estimating the extent of envenomation and assessing the possible progression (*Table 1*^{1,4-28}, which is divided by animal: (A) venomous snakes; (B) spiders, scorpions, and insects; and (C) marine animals). Diagnosis is simple if the bite or sting was witnessed and a clear history is available. However, physicians should keep in mind that misidentification of the animal is possible,

particularly in cases of snakebite. If accurate identification cannot be established, local species and their specific envenomation profiles should be considered. Local “mythology” may confuse presentation, such as in a patient with skin ulceration who blames (perhaps incorrectly) a recluse spider bite.^{13,14} Skin damage should be ascribed to spider bite only if the incident occurred within the range of recluse spiders and if more likely causes, such as infection, are excluded.^{13,14}

It is advisable to obtain early consultation with a toxinologist or a physician experienced in treating envenomations. Careful assessment of the clinical effects, guided by knowledge of the onset of each sign and symptom, will ensure that important diagnostic clues are not missed, nor management imperatives overlooked. Physicians should keep in mind that the patient is focused only on ensuring an optimal outcome, not on the interest value or the rarity of the bite. This point may seem obvious, but it is sometimes overlooked by intrigued physicians.

In North America, where pit vipers (e.g., rattlesnakes, copperheads, water moccasins) are the most common source of venomous snakebites, acute risks on initial presentation may include rapidly developing edema of the bitten limb, with fluid shifts and secondary shock, coagulopathy with major secondary bleeding, and allergic response to the venom, such as angioedema and

anaphylaxis.^{15,17} Physicians should watch for later fluid reabsorption from the bitten limb, which can lead to fluid overload and secondary cardiac failure. Although North American coral snakes (*Micrurus* species and *Micruroides euryxanthus*) rarely cause envenomations, effects can range from moderate local effects to rapid flaccid paralysis and respiratory failure.^{29,30} Unlike bites from most pit vipers, coral snakebites can be painless and may seem trivial, but paralysis can develop later and progress rapidly.

Envenomation by exotic snakes may result in a greater range of urgent presenting problems, often requiring early antivenom therapy and consultation with a clinical toxicologist familiar with exotic species. The pattern of clinical effects varies among species, but can include one or more of the following: flaccid paralysis, systemic myolysis, coagulopathy, hemorrhagic diathesis, renal failure, cardiac failure, severe bite site injury or necrosis, bite site abscess, "allergic" reactions, and nonspecific general symptoms.^{1,15} Envenomation by some exotic arthropods (e.g., some scorpions, Australian funnel-web spiders) can cause a rapid and severe catecholamine storm that is difficult to manage, potentially lethal, and often responsive only to early administration of specific antivenom.⁴

Laboratory tests can be crucial in determining the nature and severity of envenomation in patients with snakebite, but less so in those with bites from other organisms. Imaging is rarely needed, except when secondary pulmonary edema is possible (e.g., in some scorpion envenomations, children, or patients with a history of relevant comorbidities [e.g., congestive heart failure]) or when looking for spine remnants in patients with injuries from stingrays, scorpion fish, or sea urchins.

Frequent reevaluation of the extent of envenomation is required using reexamination and serial laboratory tests. In some cases, the earliest signs of severe or life-threatening envenomation may not appear for up to 24 hours. These clinical delays more commonly occur after envenomation from nonnative species.

Management

There are few established evidence-based protocols, practices, or interventions in clinical toxicology. Several large-scale studies, such as the prospective Australian Snakebite Project,³¹ will likely contribute to an increasing evidence-based trend in the management of some envenomations.

FIRST AID

For many types of envenomation, appropriate first aid can significantly reduce patient risk. Common first aid

methods that are unhelpful or dangerous include arterial tourniquets, incision and/or suction, patented venom extraction devices, electric shock guns, cryotherapy, and application of oxidizing substances (e.g., permanganate) or proteases (e.g., papain, other meat tenderizers). All of these methods have been proven, experimentally and in clinical studies, to be inappropriate, and they are contraindicated.^{32,33}

ANTIVENOM

Only some envenomations will result in serious damage, even when a highly toxic species is involved. Therefore, only some cases will require medical intervention, and not all of these will require antivenom therapy. Antivenom is the key treatment, but it cannot treat all problems effectively. Although it is most effective when given early, the potential for adverse reactions limits its use to patients with clear indications, such as those exhibiting the onset of toxic effects. Administering antivenom just because a patient has been bitten or stung by a dangerous species is inappropriate in the absence of objective evidence of envenomation. Conversely, withholding antivenom (if available) in the presence of serious envenomation is rarely justified.

A careful history must be obtained from envenomed patients whenever possible because previous bites or stings, or captive husbandry and handling of venomous snakes or lyophilized venoms increases the risk of anaphylaxis.³⁴

The decision about whether to administer antivenom is guided by clinical findings, but indications differ by species. In patients with envenomations from nonnative species, the choice and availability of antivenom may be an issue. The Antivenom Index (<http://www.pharmacy.arizona.edu/avi/index#top> [subscription required]) identifies the availability of antivenom and locations of stock for zoos and poison control centers; physicians should contact a poison control center for information on exotic antivenom availability (telephone: 800-222-1222). Clear guidelines are often lacking for envenomations involving nonnative species. When treating envenomations from nonnative species, physicians should seek prompt expert advice from a poison control center and via medical expert Web sites, such as Clinical Toxicology Resources (<http://www.toxinology.com>).

In patients with bites from North American pit vipers, antivenom should be given if there is evidence of severe systemic envenomation or rapidly increasing or major local swelling, especially if there is blistering or bleb formation. Shock is especially serious in children, and aggressive fluid resuscitation is often needed. The onset

Table 1A. First Aid and Treatment Recommendations: Snake Envenomations

Animal	Type of envenomation	First aid*	Clinical presentation	Laboratory tests
Pit vipers Gila monster (<i>Heloderma suspectum</i>)	Coagulopathic and/or hemorrhagic, with or without paralytic features	Limit ambulation (carry victim, if possible) Splint affected limb below heart level <i>Except for Gila monster, copperhead, water moccasin, or pygmy rattlesnake envenomations, consider pressure and immobilization if substantial delay in treatment or neurotoxic features are expected</i> Remove all constrictive clothing and jewelry from extremities Give fluids as tolerated (not orally, if possible) and acetaminophen; withhold other medications until after medical evaluation, if possible Arrange urgent transport to medical facility; if possible, notify facility before arrival Contraindicated: cryotherapy, ice, NSAIDs (may cause bleeding), constricting ligatures, incision and/or suction, illicit drugs, alcohol	Local pain Fang marks may be present, but are often undetectable Edema (may be rapidly progressive) Ecchymoses (may become massive without treatment) Hemorrhagic blisters or blebs Compartment syndrome (uncommon) Systemic effects (e.g., lymphadenopathy, lymphangitis, nausea, vomiting, perioral paresthesia, metallic taste, hypotension, hypertension [particularly in Gila monster envenomation], diarrhea, vertigo, shock, hyperreactive airway, loss of consciousness) Paralytic features (e.g., weakness, ptosis, respiratory distress, bulbo-spinal paresis) Occasionally, dark urine (e.g., myoglobinuria/rhabdomyolysis)	Basic tests† PT/INR APTT Fibrinogen (measured, not calculated) D-dimer Platelet count ABG (as indicated) CPK Urinalysis Cardiac enzymes (as indicated)



Treatment

Large-gauge IV access for fluids; provide fluid bolus and repeat as indicated

Anaphylaxis protocol

Intubation and ventilation may be necessary in envenomations with paralytic features (e.g., from Mojave rattlesnake [*Crotalus scutulatus scutulatus*])

Wound care and supportive management (e.g., fluid resuscitation, non-sedating analgesia, monitoring of patients with comorbidities) are essential for Gila monster envenomations

General treatment considerations:

Compartment syndrome requiring surgical intervention is a relatively uncommon complication of pit viper envenomation that may be confused with direct venom-induced muscle necrosis. Wick catheter or other intracompartmental pressure measurement > 30 mm Hg is required for diagnosis. If compartment syndrome is present, urgent surgical consultation is required.

Additional treatments may include non-sedating analgesia, coagulation factor and platelet replacement (controversial; currently under investigation), dialysis for established renal failure, urine alkalization for myoglobinuria (uncertain value), and respiratory support as indicated.

After administration of antivenom, a short, nontapered course of prednisone (40 to 60 mg daily for five days) should be given to decrease the incidence of type III immune complex disease. Wound care and tetanus prophylaxis should be provided as indicated. Antibiotics are indicated only if evidence of infection is present.

Antivenom indications:‡

A grading system may be used to approximate the degree of envenomation, but should be balanced with individual presentation and comorbidities:§

0 = nonenvenomation ("dry" bite). Fang marks may or may not be visible; no local or systemic effects. Antivenom is not indicated.

1 = minimal envenomation. Local effects (pain, edema) are limited to the bite site; no systemic effects or laboratory abnormalities. Antivenom is not usually needed, but may be given if clinical progression occurs.

2 = moderate envenomation. Extension of local effects, but the entire bitten extremity is not involved; systemic signs (e.g., nausea, vomiting, metallic taste); some laboratory abnormalities (e.g., thrombocytopenia, prolonged INR, elevated CPK level). Antivenom is required.

3 = severe envenomation. Rapidly progressing edema; blistering and ecchymoses; shock; altered sensorium; multiple laboratory abnormalities (e.g., markedly prolonged INR, severe thrombocytopenia [platelet count < 20,000 mm³]); fibrin degradation products; renal insufficiency or failure. Antivenom is required with a high initial dose. Large subsequent doses are often required.

Antivenom dosing and administration: ||

Give Crotalidae polyvalent immune Fab (ovine): 4 to 6 vials, each reconstituted (10 mL saline) and diluted in 250 mL saline, IV administration.

Initial infusion of 20 to 60 mL per minute; increase to 250 mL per hour if no adverse reactions occur.

Give additional 4 to 6 vials, followed by 2 vials every six hours for 18 hours (14 to 18 vials total) as indicated; higher doses may be required for severe envenomations.

Presynaptic envenomation by species such as Mojave rattlesnakes may require higher doses and may be ineffective in late presentations, requiring intubation and ventilation.

Delayed absorption of sequestered venom is possible; because of the variably short half-life of the antivenom (12 to 23 hours), serial assessment of INR is essential (e.g., reversal of prolonged INR is sufficient to withhold further antivenom, but INR must be monitored for 24 to 48 hours [sometimes longer]).

All patients with serious envenomation must be counseled about the risk of antivenom anaphylaxis, immune complex disease, and possible loss of function, regardless of treatment effectiveness.

Table 1A continues

Table 1A. First Aid and Treatment Recommendations: Snake Envenomations (continued)

Animal	Type of envenomation	First aid*	Clinical presentation	Laboratory tests
Coral snakes (<i>Micrurus</i> species)	Postsynaptically neurotoxic	Same as for pit vipers and Gila monster; pressure and immobilization may be used regardless of proximity to medical facility	Local pain (variable, usually mild) Fang marks often undetectable Weakness Ptosis Respiratory distress (respiratory support may be indicated) Bulbospinal paresis	Same as for pit vipers and Gila monster

**Treatment**

General treatment considerations (as with pit vipers and Gila monster)

Antivenom indications: ¶

Any evidence of paralytic signs is an indication for antivenom; use of a grading system is strongly discouraged.

Antivenom dosing and administration:

Initial dosage is dependent on the product; give additional vials as needed.

Consultation with a toxinologist is strongly advised, as is review of the Antivenom Index (<http://www.pharmacy.arizona.edu/avi/index#top> [subscription required]).

All patients with serious envenomation must be counseled about the risk of antivenom anaphylaxis, immune complex disease, and possible loss of function, regardless of treatment effectiveness.

ABG = arterial blood gas; APTT = activated partial thromboplastin time; CPK = creatine phosphokinase; FDA = U.S. Food and Drug Administration; INR = International Normalized Ratio; IV = intravenous; NSAIDs = nonsteroidal anti-inflammatory drugs; PT = prothrombin time.

*—All first aid recommendations assume the immediate provision of airway, breathing, and circulation measures.

†—Basic laboratory tests include complete blood and metabolic profiles, including liver function tests.

‡—Crotalidae polyvalent immune Fab (ovine) is the only antivenom currently available for pit viper envenomations. No antivenom is available for Gila monster envenomations.

§—Grading systems should not be used in a restrictive manner. For example, a single isolated significant abnormal finding (e.g., < 80 mm Hg systolic blood pressure, markedly prolonged INR) should be considered supportive of an evolving serious envenomation.

||—Dosage for children is the same; dosage for pregnant women should reflect extent of envenomation (FDA category C).

¶—The coral snake antivenom formerly manufactured by Wyeth is no longer in production; an alternative formulation (Coralmyn) is being tested.

Information from references 1, and 4 through 28.

of any of these symptoms is an indication for urgent administration of antivenom.^{15,17} Mild swelling in the absence of systemic envenomation is not an indication for antivenom. In patients with coral snakebites, any degree of flaccid paralysis warrants antivenom therapy.

It is important to note that the major neurotoxins (e.g., crotoxin, Mojave toxin) in some rattlesnake venoms are presynaptic in action. In late presentations of envenomation from these snakes (i.e., in patients with paralytic features, ptosis is an early sign), antivenom has poor effectiveness in reversing the paresis, and intubation and ventilation may be life-saving.

Scorpion stings from species in the southwest United States (primarily *Centruroides sculpturatus*) require urgent administration of antivenom in patients with rapid-onset envenomation, those in distress from pain, and in children with possible choreoathetoid movements. Spider bites from U.S. species are not likely to cause envenomation that requires urgent administration of antivenom. However, children and older persons,

as well as patients with serious comorbidities (especially cardiovascular disease) who are envenomed by black widow spiders (*Latrodectus* species) may require early administration of antivenom. The use of antivenom for widow spider bites is controversial, but available data suggest that it is safe and effective, and may reduce the length of hospitalization.³⁵

Antivenom should be given intravenously, with an initial dose equal to the amount expected to fully neutralize the average envenomation by the relevant species. If it is clear that envenomation is severe, a higher initial dose may be justified. Follow-up doses may be required but should be infrequent, except in cases where the antivenom has a short half life, such as Crotalidae polyvalent immune Fab (ovine), which usually requires follow-up doses to maintain adequate neutralizing levels while further venom is being absorbed from the bite site (i.e., recurrence phenomena or delayed toxicity³⁶).

Crotalidae polyvalent immune Fab (ovine) is approved for mild to moderate envenomation by rattlesnakes

Table 1B. First Aid and Treatment Recommendations: Spider, Scorpion, and Insect Envenomations

<i>Animal</i>	<i>Type of envenomation</i>	<i>First aid*</i>	<i>Clinical presentation</i>	<i>Laboratory tests</i>
Widow spiders (<i>Latrodectus</i> species)	Neurotoxic	Consider insulated ice pack application to bite site (limit to 10 minutes per hour for three hours) Arrange urgent transport to medical facility	<p>Widow spiders:</p> <p>Serious bites are usually felt as a mild sting</p> <p>Local pain may develop within minutes or up to 10 hours later</p> <p>Pain may become severe, with or without local sweating, erythema, central blanching, or petechiae</p> <p>Pain may extend proximally (for bites on extremities) or become regional, presenting as chest pain (mimicking angina), abdominal pain (mimicking acute abdomen), or head/neck pain (contorted facies latrodectisma)</p> <p>Hypertension</p> <p>Nausea</p> <p>Muscle spasms</p> <p>Untreated bites may result in leg pain and can be associated with profuse lower limb sweating (even with bites to the upper extremities)</p> <p>Pulmonary edema and generalized paralysis are rare</p> <p>Untreated major systemic envenomation can cause serious symptoms over two to five days, and up to weeks</p>	<p>Basic tests†</p> <p>Platelet count</p> <p>ABG (as indicated)</p> <p>CPK</p> <p>Urinalysis</p> <p>Cardiac enzymes (as indicated)</p>
Arizona bark scorpion (<i>Centruroides sculpturatus</i>)				
<i>Treatment</i>				
Wound care as indicated			Antivenom dosing and administration:	
Obtain IV access			Administer 1 vial of antivenom (2.5 mL) diluted in 200 to 250 mL saline over two hours; additional vials may be titrated against persistent muscle spasm or pain; antivenom may be given up to one week after a serious envenomation.‡	
Anaphylaxis protocol			Patients should be counseled about the risks and benefits of antivenom therapy.	
General treatment considerations:			Arizona bark scorpion:	
All patients with serious envenomations should be closely monitored; those with cardiovascular comorbidities should be monitored continuously.			Antivenom indications: signs of systemic neurotoxicity; indications for local envenomation have not been established.§	
Additional treatments may include non-sedating analgesia, benzodiazepines for muscle spasm, and tetanus prophylaxis.			Antivenom dosing and administration are dependent on the product, as advised by a poison control center.	
After administration of antivenom, a short, nontapered course of prednisone (40 to 60 mg daily for five days) should be given to decrease the incidence of type III immune complex disease.			Patients should be counseled about the lack of FDA approval for this antivenom.	
Ensure close follow-up after discharge for all patients with serious envenomations.			All patients with serious envenomation must be counseled about the risk of antivenom anaphylaxis, immune complex disease, and possible loss of function, regardless of treatment effectiveness.	
Widow spiders:				
Antivenom indications include increasingly severe pain, proximal spread of muscle spasm, rigidity from bite site to abdomen and head, increased sweating, and hypertension.				

Table 1B continues

Table 1B. First Aid and Treatment Recommendations: Spider, Scorpion, and Insect Envenomations

(continued)

Animal	Type of envenomation	First aid*	Clinical presentation	Laboratory tests
Recluse spiders (<i>Loxosceles</i> species) 	Necrotic	No first aid recommendations Prompt evaluation by a physician is strongly advised Capture of spider (with strict safety precautions) is strongly advised	Cutaneous loxoscelism: Local pain (moderate to severe) Erythema (may show clinically six to 24 hours after bite) Edema Mottled dark or hemorrhagic foci, with or without local blistering General symptoms (e.g., fever, malaise, rash) Lesion evolution over five to seven days (necrosis or ulceration, possible dry gray or blue-black eschar) Necrotic wound may extend over several weeks, with or without recurrent breakdown, pain, and ulceration Severe cases may have necrotic extension well beyond the dermis Viscerocutaneous loxoscelism (uncommon to rare): Presentation similar to cutaneous loxoscelism, with potentially lethal systemic effects (e.g., hemolysis, thrombocytopenia, disseminated intravascular coagulation, secondary renal failure, shock)	Basic tests† Evidence of local infection requires standard microbiologic culture and sensitivity testing

Treatment

Meticulous wound care is essential in patients with confirmed loxoscelism.

No antivenom is available in the United States, and no specific treatment (e.g., dapsone, early debridement) is supported by the evidence.

Anecdotal reports of effectiveness of hyperbaric oxygen therapy are unproven.

Patients with confirmed loxoscelism should be counseled about potential chronic and complicated sequelae.

Animal	Type of envenomation	First aid*	Clinical presentation	Laboratory tests
Stinging insects Other arthropods (including theraphosid spiders) 	Local	Remove stinger with forceps, if applicable (do not squeeze venom gland on end of stinger) Except for <i>tarantula</i> envenomations, briefly apply insulated ice pack to bite site (limit to 10 minutes per hour for three hours) Acceptable to give diphenhydramine (Benadryl) or desloratadine (Clarinx) Serious stings should be evaluated by a physician Obtain history of stings and atopic tendencies, watch for signs of anaphylaxis, and manage per protocol Persons with known atopy should receive epinephrine via preloaded syringe or in the emergency setting; emergent airway management may be indicated	Local pain, erythema, and edema of variable severity Hyperreactive airway or anaphylaxis can occur if atopy to insect venoms is present	Usually not required; evaluate on a case-by-case basis

Treatment

Airway, breathing, and circulation are first priority
 Major concern is atopic response with the possibility of anaphylaxis; treatment is focused on thorough history, careful observation for escalating local or systemic reactions, and immediate availability of anaphylaxis protocol

Wound care
 Severe pain can be managed with modest use of opioids (hydrocodone/acetaminophen)
 Tetanus prophylaxis and follow-up
 Secondary infections require broad-spectrum antibiotics

ABG = arterial blood gas; CPK = creatine phosphokinase; FDA = U.S. Food and Drug Administration; IV = intravenous.

*—All first aid recommendations assume the immediate provision of airway, breathing, and circulation measures.

†—Basic laboratory tests include complete blood and metabolic profiles, including liver function tests.

‡—Dosage for children is the same; dosage for pregnant women should reflect extent of envenomation (FDA category C).

§—There is no FDA-approved antivenom for scorpion envenomations; one is currently being tested (*Centruroides F(ab)2*). Contact the Arizona Poison and Drug Information Center for additional information (telephone: 800-222-1222).

Information from references 1, and 4 through 28.

Table 1C. First Aid and Treatment Recommendations: Marine Animal Envenomations

Animal	Type of envenomation	First aid*	Clinical presentation	Laboratory tests
Venomous fish (e.g., stingray, catfish)	Local, cytotoxic, or penetrative traumatic	Remove victim from water Stingray spines located near vital organs should not be touched, and the wound should not be rubbed or handled Stanch significant bleeding with carefully applied local pressure Hot water immersion or exposure for short-term analgesia (up to two hours) Acetaminophen is ineffective but may be given for psychological comfort Contraindicated: nonsteroidal anti-inflammatory drugs, use of illicit drugs or alcohol	Local pain (may be severe) Bleeding (significant in some cases) Edema and erythema Lymphadenopathy and lymphangitis Vomiting and abdominal pain in some cases Hypotension and shock Penetrative stingray wounds to vital organs may cause rapid systemic effects and can be fatal	Usually not required; evaluate on a case-by-case basis
<i>Treatment</i>				
Airway, breathing, and circulation are first priority Wound care Ongoing pain may require nonsedating analgesia or regional nerve block Tetanus prophylaxis and follow-up Secondary infections require broad-spectrum antibiotics			Hot water immersion or exposure for short-term analgesia (up to two hours) Fluid resuscitation is advised Consider imaging and surgical consultation for penetrative traumatic envenomation before spine removal	



Animal	Type of envenomation	First aid*	Clinical presentation	Laboratory tests
Jellyfish (cnidarian)	Local	Remove victim from water Carefully remove adherent tentacles with gloved or otherwise protected hands; do not handle tentacles with bare hands Submerge or shower affected area in hot water (uncomfortable, but not scalding) for five to 10 minutes; repeat at 15-minute intervals for up to two hours Acetaminophen is ineffective Contraindicated: application of alcohol or vinegar, nonsteroidal anti-inflammatory drugs, use of illicit drugs or alcohol	Moderate to severe local pain Typical sting contact marks Occasionally, systemic effects (e.g., headache, vomiting, abdominal pain) Rarely, respiratory arrest and cardiac failure or arrest	Usually not required; evaluate on a case-by-case basis
<i>Treatment</i>				
Airway, breathing, and circulation are first priority Wound care Ongoing pain may require nonsedating analgesia or regional nerve block			Tetanus prophylaxis and follow-up Secondary infections require broad-spectrum antibiotics	



Table 1C continues

(*Crotalus* species), but published clinical experience indicates that it is also effective for severe envenomation.³⁷ It has been used for copperhead (*Agkistrodon contortrix*) envenomations, but controlled trials with long-term follow-up are needed to evaluate its use in these cases.³⁸ Its effectiveness for envenomations by water moccasins (*Agkistrodon piscivorus*), pygmy rattlesnakes (*Sistrurus miliarius*), and massasaugas (*Sistrurus catenatus*) requires formal clinical assessment. Coral snake

envenomation requires specific anti-coral snake antivenom. Although the coral snake antivenom formerly manufactured by Wyeth is no longer in production, an alternative formulation from Mexico (Coralmyn) is being tested.³⁹ An antivenom for serious scorpion stings in the Southwest is also being tested (*Centruroides* F(ab)2); initial results indicate promising effectiveness.⁴⁰

All antivenoms have the potential to cause early and late adverse effects, including anaphylactic reactions

Table 1C. First Aid and Treatment Recommendations: Marine Animal Envenomations (continued)

Animal	Type of envenomation	First aid*	Clinical presentation	Laboratory tests
Sea anemones Stinging corals	Local	No first aid recommendations Serious stings should be evaluated by a physician	Local pain, erythema, and edema of variable severity	Usually not required; evaluate on a case-by-case basis
				
<i>Treatment</i>				
Same as for jellyfish Severe pain can be managed with modest use of opioids (hydrocodone/acetaminophen)				

*—All first aid recommendations assume the immediate provision of airway, breathing, and circulation measures.
Information from references 1, and 4 through 28.

on first exposure. For this reason, antivenom should be given only in a setting where resources to manage anaphylaxis are immediately available. Pretesting for allergy to antivenom is no longer recommended.^{28,41,42} The use of premedication before administration of antivenom is controversial and not widely practiced; evidence indicates that neither steroids nor antihistamines provide benefit.

In addition to antivenom, other key therapies to be considered in patients with envenomation are listed in Table 1.^{1,4-28} Detailed information about additional strategies for management of natural toxin diseases is available online at <http://www.toxinology.com>.

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