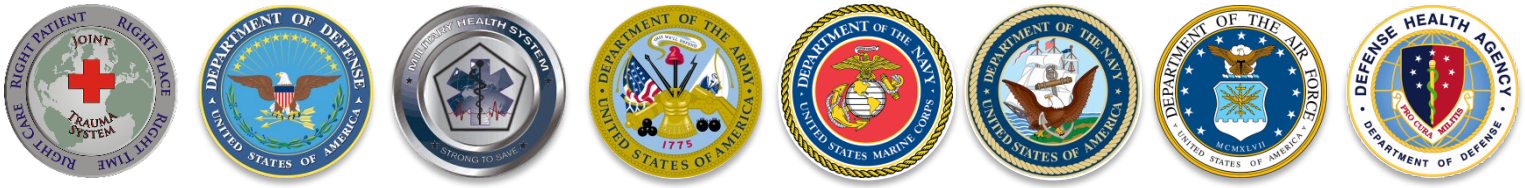
Joint Trauma System

Global Spider and Scorpion Envenomation Management

Part of the Joint Trauma System (JTS) Clinical Practice Guideline (CPG) Training Series



"Medically Ready Force…Ready Medical Force"

Purpose

This CPG provides an overview of spider and scorpion envenomation and presents a standardized approach to providers in the evaluation and treatment of patients with spider or scorpion induced poisoning.

This presentation is based on the JTS Global Spider and Scorpion Envenomation Management CPG, 09 Feb 2021 (ID:84). It is a high-level review. Please refer to the complete CPG for detailed instructions. Information contained in this presentation is only a guideline and not a substitute for clinical judgment.

Agenda

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1. Summary
2. Spiders: Window Spiders, Violin Spiders, Tarantulas, Funnel Web Spiders
3. Scorpions
4. Adverse Reactions to Antivenom
5. Performance Improvement (PI) Monitoring
6. Appendices
7. Contributors

Summary

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- Arthropods are a diverse group which produce a variety of toxins.
- Spider and scorpion envenomation occurs in many environments in which the military operates.
- Patients may not know they were attacked by arthropods as many injuries are painless or felt as a pinprick.
- Most spider bites and scorpion stings result in mild symptoms.
- Anaphylaxis is the most concerning initial effect.
  - ❑ Anaphylaxis in patients with asthma has led to death.
- Assess tetanus status. Administer vaccine and/or immunoglobulin if required.

Spiders - Overview

While many spider species produce venom, the vast majority lack sufficiently large or strong enough fangs to penetrate human skin and cause clinically significant effects.

Geographical Location of Clinically Significant Venomous Spider Species			
Continent	**Latrodectus (i.e. Black Widow)**	**Loxosceles (i.e. Brown Recluse)**	**Funnel Web**
Africa	X	X	
Asia	X	X	
Australia	X	X	X
Europe	X		
North America	X	X	
South America	X	X	

Widow Spider - Background

- Widow spiders (*Latrodectus spp.*) are found on various continents in temperate and tropical latitudes, and inhabit shady enclosed spaces.
- The lack of a red or yellow demarcation on the spider does not exclude it from being a *Latrodectus spp*.
- Patients may or may not feel a pinprick upon the initial bite.
  - A pair of small red spots at the envenomation site may be visible.
  - The bite site is often not located.
- Pathophysiology: Widow spider venom consists of multiple toxins which activate the nervous system and muscle contraction.

Widow Spider - Symptoms

- Primary symptom is painful muscle cramping.
- Patients may develop a painful, rigid abdomen secondary to abdominal muscle spasm which may be mistaken for peritonitis.
- Other symptoms, which can last for days, include vomiting, diaphoresis, tachycardia, hypertension, and restlessness.
- Fatalities are rare.

Widow Spider Treatment

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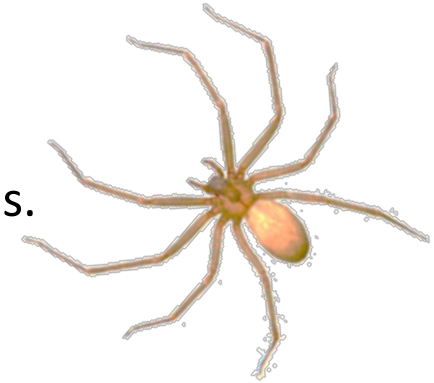
- Treatment consists of supportive care, pain management, and wound care (to include tetanus prophylaxis).
- Given the low risk of infection, antibiotics are not routinely recommended.
- Depending upon the severity of pain, acetaminophen, nonsteroidal anti-inflammatory agents, and opioids can be used for pain control.
  - In patients with severe pain refractory to pain medications, antivenom (if available) may be indicated but not readily available.
- Pain control and benzodiazepines are often sufficient to manage tachycardia and hypertension.
- Benzodiazepines may improve muscle spasms.

Violin Spiders - Background

- *Loxosceles reclusa* in a venomous spider more commonly known as the brown recluse, violin spider, or fiddleback spider for the brown shape resembling a violin or fiddle on the dorsum of its cephalothorax.
- The *Loxosceles* genus has a worldwide distribution.
- The spiders prefer dark areas.
- Pathophysiology: *Loxosceles* venom is cytotoxic (toxic to living cells) and consists of two main constituents:
  - Hyaluronidase facilitates the spreading of the venom into tissue.
  - Sphingomyelinase-D causes necrosis and hemolysis.
    - Sphingomyelinase also triggers an inflammatory reaction in red blood cells, resulting in vessel thrombosis, tissue ischemia, and necrosis.

Violin Spiders – Signs & Symptoms

- Loxoscelism will present as an ulcerative lesion, sometimes not until days after the initial envenomation.
- Within several hours after the initial bite there will be local ischemia resulting in pain, pruritus and swelling.
- A blister or a central area of purple discoloration will form.
  - Venom causes vasoconstriction and can result in a pale border around the central ulcer/blister/discoloration.
  - Over days the ulcer enlarges and the borders demarcate until 1-2 weeks after the initial bite.
- Testing is not indicated for non-necrotizing local symptoms.



Violin Spiders – Treatment

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- Treatment of local symptoms includes:
  - ❑ Wound care
  - ❑ Tetanus prophylaxis
  - ❑ Analgesics
  - ❑ Antipruritics
- There is no antivenom available.
- Early excision, intralesional injection of corticosteroids, and dapsone are not indicated.
- Admit patients with an expanding necrotic lesion or symptoms of systemic loxoscelism to a medical facility.
  - ❑ Perform complete blood cell count, urinalysis for blood, metabolic panel, liver function and coagulation studies.
- In patients who develop hemoglobinuria, increased IV fluid hydration can be used to prevent acute renal failure.
- Treat significant hemolysis with transfusions.

Tarantulas

- While tarantulas are feared due to their large size and painful bite, their bite is not dangerous to humans.
- Some indigenous American tarantula species have barbed hairs with which they can strike their victims or they can generate a cloud of hairs as a defense mechanism. The hairs can cause pruritus of the skin, eyes, and respiratory tract.
  - Adhesive tape can be used to remove barbed hairs from the skin.
  - If hairs get in the eye, then irrigate copiously. If irrigation is ineffective, then removal by an ophthalmologic surgeon may be necessary.
- Treatment includes cool compresses, analgesics, antipruritics and tetanus prophylaxis as indicated.
- Treat skin irritation with topical and oral antihistamines and corticosteroids.

Funnel Web Spiders - Background

- Australian funnel web spiders (*Atrax*) are named for the tubular or funnel-shaped web they build. They prefer to live on the ground in moist, temperate environments.
- They are capable of inducing a severe and potentially fatal neurotoxic envenomation syndrome.
- Funnel web spiders can bite tenaciously and may have to be physically removed.
- Pathophysiology: the lethal component of funnel web spider venom is robustotoxin. It induces an autonomic storm by causing excessive release of acetylcholine, norepinephrine, and epinephrine.

Funnel Web Spiders – Signs & Symptoms

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- Funnel web spider envenomation causes a biphasic envenomation syndrome.
- 1st phase: pain at the bite site, perioral tingling, piloerection, and regional fasciculations which may progress to muscle spasm.
  - Muscle spasms may compromise airway.
  - Symptoms: nausea, vomiting, lacrimation, salivation, tachycardia, hypertension, and cardiac dysrhythmias.
  - Acute lung injury is the predominate cause of death.
- 2nd phase: first phase symptoms resolve and lead to the gradual onset of refractory hypotension, apnea, and cardiac arrest.

Funnel Web Spiders - Treatment

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- Prehospital: pressure immobilization using an elastic crepe bandage applied tightly enough to limit lymphatic spread but not to restrict blood flow.
- Transport patient to medical facility with the bandage in place; Do not remove the bandage until antivenom is about to be administered.
- An effective funnel web spider antivenom is available in Australia.
  - Initial dose of 2 vials for patients with signs of envenomation.
  - Dose of 4 vials for pulmonary edema or decreased mental status.
  - Repeat initial dose every 15 minutes until the patient clinically improves.
  - A dose of 8 vials is reported in cases of severe envenomation.

Scorpions - Background

- The majority of medically significant envenomations occur in the Middle East, tropics (e.g., Southwest Asia, Central America), and North Africa.
- Scorpions are nocturnal, hibernate in the winter, and active in warm seasons.
- Pathophysiology
  - Scorpion venoms are complex and can include phospholipase, acetylcholinesterase, hyaluronidase, serotonin, and neurotoxins.
  - Scorpion venom increases neuronal release by blocking inactivation of the sodium channel, resulting in an increase in the amplitude and duration of neuron action potential.
  - Result is excess stimulation of the central nervous system, the neuromuscular system, the sympathetic nervous system, and the parasympathetic nervous system.

Scorpions – Signs & Symptoms (1)

- Sting produces a painful local reaction with tingling or burning.
  - Erythema at the injection site is common.
  - Discoloration and necrosis sometimes occur.
- Symptoms of excess sympathetic nervous system stimulation predominate over symptoms of parasympathetic nervous system stimulation.
  - Sympathetic stimulation via excess catecholamine release produces hypertension, tachycardia, irritability, and agitation.
  - Patients may develop seizures and hyperthermia.

Scorpions – Signs & Symptoms (2)

- Clinical manifestations of the parasympathetic stimulation include:
  - ❑ Salivation
  - ❑ Nausea
  - ❑ Vomiting
  - ❑ Abdominal pain
  - ❑ Pancreatitis
  - ❑ Priapism
- Neuromuscular symptoms include:
  - ❑ Tongue fasciculations
  - ❑ Muscle spasms
  - ❑ Dysphagia
  - ❑ Dysphonia
  - ❑ Roving eye is a classic finding of severe *centruroides* envenomation
- Severe muscle spasm can result in airway compromise and respiratory arrest.
- Pulmonary edema commonly occurs in severe and fatal cases.
- *Hemiscorpius lepturus* envenomations can cause local skin necrosis.
  - ❑ In severe cases: hemolysis, disseminated intravascular coagulation, and renal failure.

Scorpion – Diagnosis

- Most patients will not develop significant symptoms.
- Patients should be observed for 4-6 hours after envenomation to ensure no delayed onset of symptoms.
- Diagnosis is based on history, symptoms, and signs of envenomation.
- Laboratory analysis may reveal an elevated white blood cell count, serum glucose, lactate dehydrogenase, and amylase.
- Perform an electrocardiogram to check for cardiac ischemia or dysrhythmias in patients with moderate to severe symptoms.

Scorpions – Treatment (1)

- Most scorpion envenomations can be managed with pain medications and routine wound management to include tetanus prophylaxis.
- For clinically significant envenomation, management focuses on symptoms.
- Benzodiazepines are the first line therapy for sympathomimetic toxicity.
  - Under dosing for sympathomimetic toxicity and seizures is common.
  - Administer aggressively to ensure symptom control.
- Intravenous propofol or phenobarbital in combination with endotracheal intubation may be used in severe cases.

Scorpions – Treatment (2)

- In patients with significant neuromuscular spasm, oral secretions, sedation, or other threats to the patient airway, perform endotracheal intubation to prevent aspiration and ensure ventilation.
- If event occurred in Iraq or Iran and *Hemiscorpius lepturus* envenomation is suspected, perform a platelet count, prothrombin time, D-dimer, and fibrinogen level, blood urea nitrogen, and creatinine to check for disseminated intravascular coagulation or renal failure.
- In patients with moderate to severe symptoms resistant to analgesics and benzodiazepines, antivenom, if available, may be indicated.

Scorpions – Treatment (3)

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Clinical Grade and Treatment of Scorpion Stings		
Grade	**Effects**	**Treatment**
1	Local effects only	Analgesia, tetanus prophylaxis
2	Mild/Moderate autonomic excitation (i.e. tachycardia, hypertension)	Benzodiazepines, cautious use of beta-antagonists and vasodilators
	Agitation and anxiety	Benzodiazepines
	Pain and paresthesias remote from the sting site	Analgesia
3	Pulmonary edema	Antivenom, noninvasive or mechanical ventilation
	Hypotension and cardiogenic shock	Antivenom, vasopressors (i.e., norepinephrine, epinephrine)
	Neuromuscular excitation, somatic neuromuscular dysfunction **or** cranial nerve dysfunction (associated with *Centruroides* species)	Antivenom, benzodiazepines
4	Multiorgan failure, coma, seizures, end-organ damage secondary to hypotension, somatic neuromuscular dysfunction **and** cranial nerve dysfunction (associated with *Centruroides* species)	Antivenom, vasopressors, sedation (benzodiazepine, propofol, phenobarbital), mechanical ventilation

Modified from Isbister and Bawaskar.

Adverse Reactions to Antivenom

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- Antivenoms can cause potentially life-threating, anaphylactoid reactions.
- Anticipate serious and potentially life-threatening anaphylactoid reactions to antivenoms not approved by the U.S. FDA.
- Keep intravenous histamine antagonists (i.e. diphenhydramine), steroids, and epinephrine at the patient's bedside prior to antivenom administration.
- Reactions can range from mild (pruritus, rash) to severe (wheezing, hypotension, respiratory distress, cardiovascular collapse, and death).
- Antivenoms may cause serum sickness.
  - Serum sickness: type III hypersensitivity reaction characterized by flu-like symptoms with or without a rash which occurs 2 days to 3 weeks after antivenom administration.
  - Serum sickness is uncomfortable but not life threatening.
  - Treat with antihistamines and pain meds with or without a course of oral steroids.

Adverse Reaction Management

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- For **mild to moderate symptoms** occurring during antivenom infusion (e.g., nausea, vomiting, pruritus, chills, fever), stop the infusion immediately.
  - ❑ Treat symptoms with antiemetics, antihistamines (i.e. diphenhydramine), and steroids (i.e. methylprednisolone, prednisone).
- For **severe reactions** (i.e. respiratory distress, hypotension), immediately stop antivenom infusion and treat using a standard anaphylaxis protocol.
  - ❑ diphenhydramine 50 mg (1 mg/kg in pediatric patients) IV
  - ❑ methylprednisolone 125 mg (2 mg/kg in pediatric patients) IV
  - ❑ 0.3 mg (0.15 mg in pediatric patients) of 1:1000 epinephrine intramuscularly.
- Consider adding an H2 antihistamine such as famotidine.
- If necessary, intubate for airway edema not rapidly responsive to epinephrine.
- If antivenom is considered necessary to prevent death or disability, reinitiate antivenom at a slower rate in conjunction with an epinephrine infusion.

Scorpions - Antivenoms

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Data regarding the benefits and risks of many antivenoms are limited.

Antivenoms Available in Each Country			
Country	**Species the antivenom treats**	**Antivenom**	**Antivenom dosing regimen**
Morocco	*Androctonus australis garzonii, B. occitanus tunetanus, Tityus serrulatus*	Polyvalent scorpion antivenom	2-10 mL IV
Egypt	*Leiurus quinquestraitus, Androctonus amoreuxi, Androctonus crassicauda, Androctonus aeneas, Androctonus australis, Scorpio marus palmatus, Buthus occitanus*	Purified polyvalent anti-scorpion serum (equine)	5 1-mL ampules IV
Algeria	*Androctonus australis*	Scorpion antivenom (Pasteur Institute of Algeria)	10 mL IV Note: one study showed no benefit with this dose.
Mexico, U.S.	*Centruroides limpidus, C. noxius, C. suffuses, C. exilicauda*	Polyvalent scorpion antivenom	3 vials, each reconstituted in 5 mL of sterile normal saline (NS). Combine all 3 reconstituted vials in 50 mL NS infused IV over 10 minutes
Brazil	*Tityus serrulatus*	Soro antiescorpionico	20 mL IV
South Africa	*Parabuthus spp.*	Monovalent scorpion antivenom	5-10 mL IV
India	*Hottentotta/Mesobuthus tamulus*	Monovalent red scorpion antivenom	2-8 vials, each diluted into 10 mL of distilled water and administered IV over 5-7 minutes
Tunisia	*A. australis, B. occitanus*	Bivalent scorpion antivenom (Institut Pasteur, Tunis, Tunisia)	20 mL IV; however, one study showed no benefit
Saudi Arabia	*Leiurus quinquestriatus, Androctonus crassicauda, Buthus arenicola, Buthus mimax, Buthus occitanus, Leiurus quinquestriatus hebreus, A. amoreuxi*	Polyvalent scorpion antivenom	Manufacturer recommends 1 ampule, repeated until symptoms controlled. One study found a typical effective dose to be 5 to 20 1-mL ampules IV
Israel	*Leiurus quinquestriatus*	Monovalent scorpion antivenom	5 to 15 mL of antivenom diluted in 5% dextrose and 33% sodium chloride administered IV
Argentina	*Tityus trivittatus*	Scorpion antivenom	See package instructions.
Venezuela	*Tityus zulianus*	Scorpion antivenom	See package instructions.

Appendices

- **Appendix A**: Location of Clinically Significant Venomous Spider Species
- **Appendix B**: Clinical Grade and Treatment of Scorpion Stings
- **Appendix C:** Scorpion Antivenoms Available in Each Country
- **Appendix D**: Additional Information Regarding Off-label Uses in CPGs

PI Monitoring

- **Intent (Expected Outcomes)**
  - Rapid evaluation and transfer to site with antivenom capability for envenomation
  - Tetanus prophylaxis when appropriate
- **Performance/Adherence Metrics**
  - Transfer of patients with moderate to severe symptoms (grades 3 and 4) to antivenom if not available at site
  - Aggressive use of benzodiazepines as indicated for agitation, neuromuscular stimulation, tachycardia, and hypertension
  - Tetanus prophylaxis for all bites and stings
- **Data Source**
  - Patient Record
  - Department of Defense Trauma Registry

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