Envenomations of the Southwest

Daniel E Brooks MD
Department of Medical Toxicology
Co-Medical Director; Banner Good Samaritan Poison and Drug Information Center

Outline
Scorpions
Gila Monsters
Blackwidow
Africanized Bees
Rattlesnakes

Scorpions: Introduction
Phylum Arthropoda
Subphylum Chelicerata
Class Arachnida
Order Scorpionida

As many as 1400 species reported with ~ 30 capable of producing clinically significant envenomation

Buthidae largest / most dangerous family world-wide

Scorpions: Introduction
Crablike body shape with 7 sets of paired appendages

Tail curves upward dorsally ending in terminal bulbous

Telson - contains paired venom glands and stinger
## Scorpions: Introduction

Envenomation can result in distinct clinical syndromes

Most stings cause only local pain/inflammation

Some species in South America and North Africa can cause “autonomic storm”

Estimated 5000 deaths occur annually world-wide, 2nd only to snakes as sources of fatal envenomation

## Scorpions: Venom

Contains several enzymes, neurotoxins, serotonin and histamine

Results in repetitive axonal firing, enhancing release of neurotransmitters at synapses/NM junctions

Net effect: excessive neuromuscular activity and autonomic dysfunction

## Bark Scorpion

Of 40 species found in US, only *C. exilicauda* causes significant systemic reactions and potentially fatal

Bark scorpion- resides in/near trees

Found statewide in Arizona, some areas Texas, New Mexico, northern Mexico, California

Accounts for ~ 10% of all calls to Banner PCC

## Bark Scorpion

Relatively small (5 cm)

Uniformly yellow/tan

Thin pincers and tail
**Bark Scorpion: Envenomation**

Grade I: Local pain / paresthesias at site of envenomation

Grade II: Pain / paresthesias remote from site of sting, in addition to local findings

Grade III: Cranial nerve dysfunction (CND) or skeletal neuromuscular dysfunction (NMD)

Grade IV: CND and NMD

---

**Bark Scorpion: Treatment**

Observe for progression, symptomatic treatment

**ABCs**

- Airway secretions (?) Atropine
- Usually NOT an allergic reaction
  - (Benadryl is not routinely indicated)
- Continuous pulse oximetry and monitoring

---

**Bark Scorpion: Treatment**

Pharmacologic Interventions:

- Analgesia - fentanyl (1-2 mcg/kg IV)
- Sedative Hypnotics - midazolam (0.05-0.1 mg/kg)
- Antivenom?

---

**Bark Scorpion: Treatment**

Systemic progression → Antivenom

**Historically**

- Goat-derived Antivenin (Phoenix)
  - Risks: Hypersensitivity, serum sickness
  - Benefits: Likely discharge from ED, Rapid improvement, avoids intubation, Midazolam / Dexmedetomidine gtt
- Anascorp
  - Risks: Experimental, hypersensitivity
  - Benefits: Likely discharge from ED, rapid improvement
  - Made in Mexico, FDA approval is pending
Gila Monster
*Heloderma suspectum*

Length ~ 50 cm
Massive jaw muscles with lancet-shaped, loosely-attached teeth
Venom delivery - pair of anterior multi-lobed glands that open into labial mucosa

Gila Monster

Agitation leads to salivation and venom flow
Chewing motion instills venom into wound by capillary action along grooves of teeth
Teeth and/or Gila monster may stay attached
Effective envenomation only 70% of bites

Gila Monster

Venom
  - Kallikrein-like substances
  - Hyaluronidase
  - Protease
  - Phospholipase A₂
  - Serotonin

Gila Monster: Clinical Effects

No fatalities, wound necrosis rare
Significant bleeding, local pain
Generalized weakness, nausea, vomiting, dizziness, parasthesias, tachycardia, hypotension, diaphoresis
Coagulopathy, thrombocytopenia, ECG abnormalities, MI reported
Gila Monster: Management

- ABCs and **Detach lizard!**
- Irrigate wound
- Wound care, radiograph
- Pain control, tetanus, antibiotics not routinely required unless evidence of infection

Black Widow: Introduction

*Genus Latrodectus*

- Females 12-16mm thorax
- Female shiny black with red hour-glass on ventral abdomen
- Tend to spin downward webs
- Worldwide distribution
- Every U.S. state except Alaska

Black Widow: Venom

- Lacks locally active toxins provoking inflammation
- α-latrotoxin, which releases neurotransmitter
- Involves calcium mediated activity and non-calcium mediated membrane pore formation
- Results in release of Acetylcholine / Norepinephrine

Black Widow: Clinical Presentation

- Latrotoxism
  - Widespread, sustained muscle spasm following Latrodectus envenomation
- Initial bite may be painful
- Minimal, transient local reaction ("Target Lesion")
  - Small papule/punctum
  - Surrounding skin slight erythema/indurated
  - In most cases symptoms do not progress
### Black Widow: Clinical Presentation

**Neuromuscular signs/symptoms w/1 60 minutes**
- Involuntary spasm/rigidity of abdomen, limbs, and back
- ‘Acute abdomen’
- Fasciculations
-Weakness
-Ptosis
-Priapism
-Respiratory muscle weakness

**Autonomic signs/symptoms**
- Salivation
- Diaphoresis (can be localized)
- Hypertension/hypertensive emergency
- Fever
- Bronchorrhea

**Other:** Pulmonary edema, uterine contractions, intractable crying, *Latrodectus* facies

### Black Widow: Treatment

**Pain/muscle spasm control**
- May remain severe for *several days*
- Narcotics
- Benzodiazepines
- Calcium gluconate not helpful

**Blood Pressure**
- Shorter acting, infusions, preferable
  - easy on / off, only if analgesics / hypnotics don’t work

**Antivenom**
- Indications: Uncontrolled pain, uncontrolled HTN, ACS, respiratory arrest, seizures, pregnancy (?)

**Old Antivenom**
- Single vial reconstituted in 100mL of NSS
- given IV over 30 minutes
- No skin testing, have epinephrine at bedside

**New Antivenom**
- Experimental BioCion product Aracmyn PLUS®
**Africanized Bees**

*Apis mellifera scutellata/adansonii*

More aggressive subspecies than native European bees of North/South America

Disease-resistant African bees imported in 1956 to Brazil and interbred with domestic honeybees (*Africanization*)

Africanized bees entered United States 1990

---

**Africanized Bees: Venom**

"Africanized" and domestic similar *components, concentrations in venom sacs*

**Melittin**

- Major component
- Inserts into phospholipid layer of cell membrane
- Causes breakdown of RBCs, WBCs, platelets, vascular endothelium
Africanized Bees: Venom

- Phospholipase A₂
- Increases capillary permeability
- Morbidity and mortality associated with cumulative dose of venom injected into venom
- >100 major systemic toxicity likely
- Estimated human lethal dose = 19 stings/kg

Africanized Bees: Clinical Effects

**Minor local reaction**
- Pain
- Pruritis
- Erythema
- Urticaria

**Major local reaction**
- Angioedema
- Diffuse, widespread edema

**Major systemic reaction**
- N/V/D
- Intestinal cramping
- Bronchospasm/stridor
- Shock

**Delayed reactions (6-24hrs)**
- Hemolysis
- Thrombocytopenia
- Rhabdomyolysis
- ARF
- MI

Africanized Bees: Management

**Prehospital:** Don’t get swarmed; don’t focus on removing stingers

**ABCs**

Local reactions: Analgesia, Cool compress, topical antihistamines

Systemic reactions: IVFs, antihistamines, steroids, epinephrine, bronchodilators

**<50 Stings**
- Baseline labs: CBC, CK, BMP, UA
- Observe 6 hours
- Asymptomatic, normal labs, discharge
- Symptomatic, abnormal labs, admit

**>50 Stings**
- Baseline labs
- Admit 24 hrs observation for delayed effects, especially high risk

High risk: pediatrics, elderly, comorbidities
N. American Venomous Snakes

Medically important families include:

Viperidae (crotalines/pit vipers, copperheads)
- Found in all 48 contiguous states except Maine
- Rattlesnake most widespread

Elapidae (elapids, coral, cobra)
- Coral snakes
- Southeastern United States

Viperidae

Paired pits
- Thermoreceptor organs
- Locate prey
- Aim strikes
- Adjust venom dose
- Detect T change 0.003°C

Elliptical pupil
- Harmless snakes round

Viperidae: Venom Delivery

Bilateral venom glands
- Produce/store venom

Hollow fangs
- Highly mobile
- Voluntary control
- Brittle
- Strike at 8 ft/second

Strike reach distances ½
- body length away

¼ bites “dry”

Viperidae: Regional Species

Timber Rattlesnake (crotalus h. horridus)
- Canebrake

Eastern Massasauga (Sistrurus catenatus)

Copperhead (Agkistrodon contortrix)

Water Moccasin/Cottonmouth (A. piscivorus)
### Viperidae: Venom

Complex mixture enzymes, metals  
*Proteolytic enzymes*  
*Hyaluronidase*  
*Phospholipase A₂*  
*Thrombin-like enzymes*  
*Collagenase*  
*Rnase*  
*Dnase*

### Viperidae: Venom Effects

<table>
<thead>
<tr>
<th>Tissue injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most common complication</td>
</tr>
<tr>
<td>Enzymes directed at tissue breakdown</td>
</tr>
<tr>
<td>Increase permeability of capillary endothelium</td>
</tr>
<tr>
<td>Necrosis of skeletal muscle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coagulopathy/Thrombocytopenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrinolysins</td>
</tr>
<tr>
<td>Thrombin-like enzymes</td>
</tr>
<tr>
<td>Damage platelet membranes/initiate aggregation</td>
</tr>
</tbody>
</table>

### Viperidae: Venom Effects

<table>
<thead>
<tr>
<th>Cardiovascular toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypotension- vomiting/hemorrhage</td>
</tr>
<tr>
<td>Myocardial depressor protein</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neurotoxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mojave</td>
</tr>
<tr>
<td>Calcium-channel blockade in presynaptic neurons, inhibiting neurotransmitter release</td>
</tr>
</tbody>
</table>

### Viperidae: Clinical Presentation

<table>
<thead>
<tr>
<th>Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fang marks</td>
</tr>
<tr>
<td>Severe pain</td>
</tr>
<tr>
<td>Swelling</td>
</tr>
<tr>
<td>Oozing</td>
</tr>
<tr>
<td>Ecchymosis</td>
</tr>
<tr>
<td>Tissue necrosis</td>
</tr>
<tr>
<td>Bleb development</td>
</tr>
</tbody>
</table>
Viperidae: Clinical Presentation

Systemic effects

GI: Nausea/vomiting
CV: Hypotension, CV collapse, anaphylaxis
Neurologic: Fasciculations, paresthesias, weakness, ptosis, myokymia
Hematologic: Thrombocytopenia, prolonged PT, hypofibrinogenemia

Viperidae Bite: Management

Prehospital: Control bleeding
Elevate and immobilize effected limb (non-compressive splint)

NO ice/tourniquet/suction kits

ABCs
IVFs
Analgesia/antiemetics/tetanus
  Fentanyl

Viperidae Bite: Management

Determine envenomation
  Serial examination (progressive swelling/pain)
  Baseline platelet, PT, fibrinogen (repeat 6 hours)

No evidence of envenomation in ED - D/C

Envenomation - admit

Antivenom Administration

CroFab

Indicated with significant envenomations
  Progressive edema
  Coagulopathy
  Shock

Skin testing not routinely suggested
Risk for anaphylaxis (Wyeth >> CroFab)
CroFab Antivenom

‘Safer’ profile, apparently less effective
(edema > coagulopathy)

Reconstitute 4 to 6 vials in 500 mL of NSS
Initiate drip at 10 mL/hr; increase to 250 mL/hr

Evaluate for “Control” of envenomation
Recheck platelets, PT, fibrinogen and evidence
 of edema progression

Review of Pre-Hospital
Treatments

Scorpion - Treatment

Focus on the airway and airway secretions

Airway secretions (? Atropine)
Usually NOT an allergic reaction
Continuous pulse oximetry and monitoring
Pain medications or benzodiazepines

Gila Monster - Treatment

Detach animal if its safe

Irrigate / Clean Wound
Pain medications
**Blackwidow - Treatment**

Consider the diagnosis (elderly and children)

Follow BP, ? ECG

Pain medications

---

**Bees - Treatment**

ABCs - Secure airway

IVFs

Anaphylaxis? (Epinephrine)

Don’t Focus on the Stingers

---

**Rattlesnake - Treatment**

Immobilize Limb (straight, non-compressive splint)

No Tourniquet or Ice

IVFs (in non-effected limb)

---

**Regional Poison Center**

Available 24 hours a day, 365 days a year

Can discuss case with a nurse or on call Medical Toxicologist

602-253-3334

1-800-222-1222