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 / parasthesias 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 A_2
- 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

Latrodectism

- 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/I 60 minutes

- **Involuntary spasm/rigidity of abdomen, limbs, and back**
- **'Acute abdomen'**
- **Fasciculations**
- **Weakness**
- **Ptosis**
- **Priapism**
- **Respiratory muscle weakness**

Black Widow: Clinical Presentation

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**

Black Widow: Treatment

<u>Antivenom</u>

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

<u>Old Antivenom</u>

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

<u>New Antivenom</u>

- **Experimental BioClon product Aracmyn PLUS®**

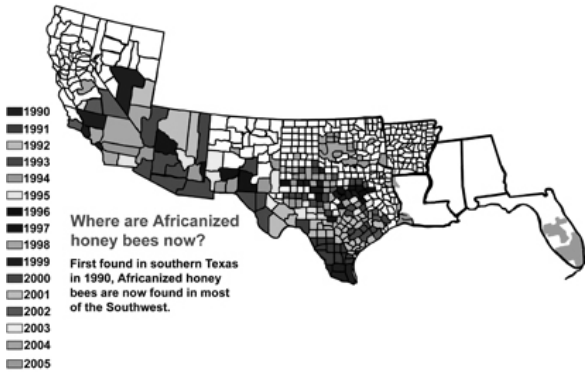
Africanized Bees

Apis mellifera scutellata/adansoni

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

Large populations

Frequent swarming

Long, nonstop flights (>20km)

Tendency toward mass attacks after minimal provocation, chase victims

"Killer bees" more aggressive

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 A_2
- 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 (8-24hrs)
- 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

Africanized Bees: Management

<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

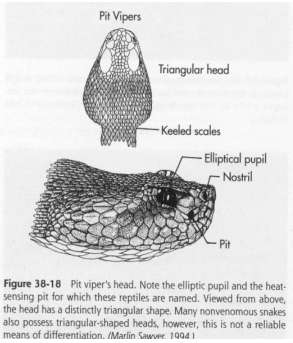
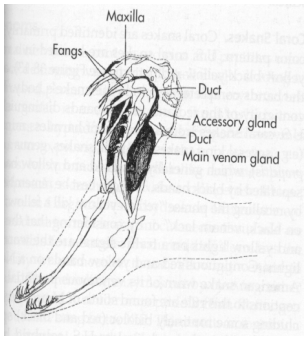


Figure 38-18 Pit viper's head. Note the elliptic pupil and the heat-sensing pit for which these reptiles are named. Viewed from above, the head has a distinctly triangular shape. Many nonvenomous snakes also possess triangular-shaped heads, however, this is not a reliable means of differentiation. *(Marlin Sawyer, 1994.)*

- **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 A_2
- Thrombin-like enzymes
- Collagenase
- Rnase
- Dnase

Viperidae: Venom Effects

Tissue injury

- Most common complication
- Enzymes directed at tissue breakdown
- Increase permeability of capillary endothelium
- Necrosis of skeletal muscle

Coagulopathy/Thrombocytopenia

- Fibrinolysins
- Thrombin-like enzymes
- Damage platelet membranes/initiate aggregation

Viperidae: Venom Effects

Cardiovascular toxicity

- Hypotension- vomiting/hemorrhage
- Myocardial depressor protein

Neurotoxicity

- Mojave
- Calcium-channel blockade in presynaptic neurons, inhibiting neurotransmitter release

Viperidae: Clinical Presentation

Local

- Fang marks
- Severe pain
- Swelling
- Oozing
- Ecchymosis
- Tissue necrosis
- Bleb development

Viperidae: Clinical Presentation

Systemic effects

- **GI: Nausea/vomiting**
- **CV: Hypotension, CV collapse, anaphylaxis**
- **Neurologic: Fasciculations, parasthesias, 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 Adminsitration

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