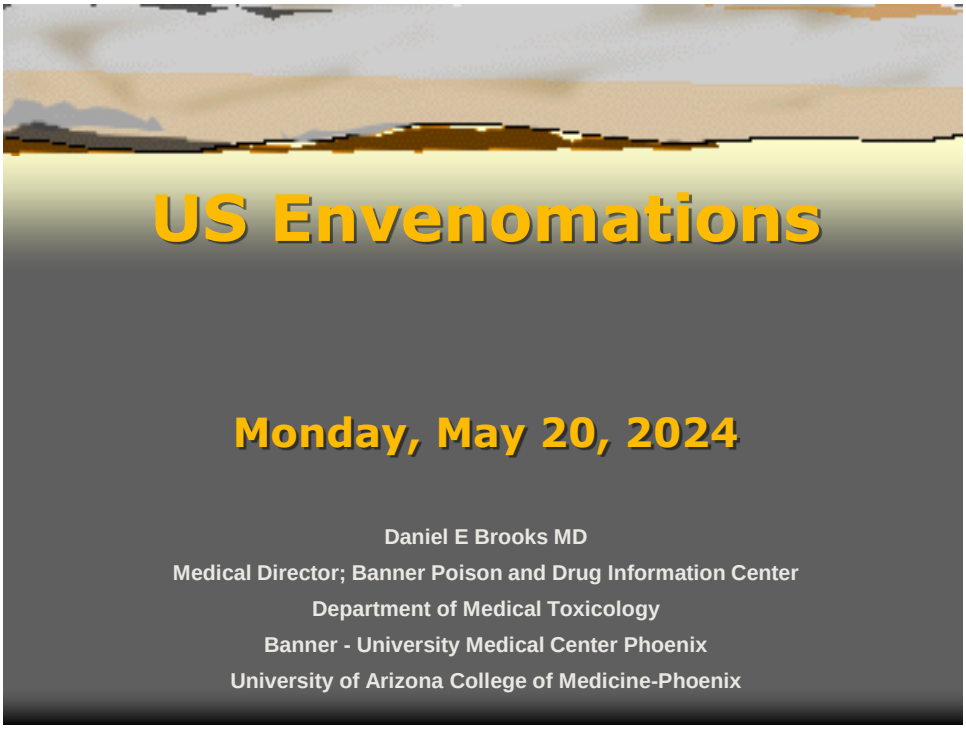
US Envenomations
Monday, May 20, 2024
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Outline
Scorpions
Black widow Spider
Rattlesnakes
Bees
Gila monster

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Objectives

Provide an overview of Envenomations encountered in the US

Outline pathophysiology of these injuries

Discuss optimal, initial care of patients with envenomations

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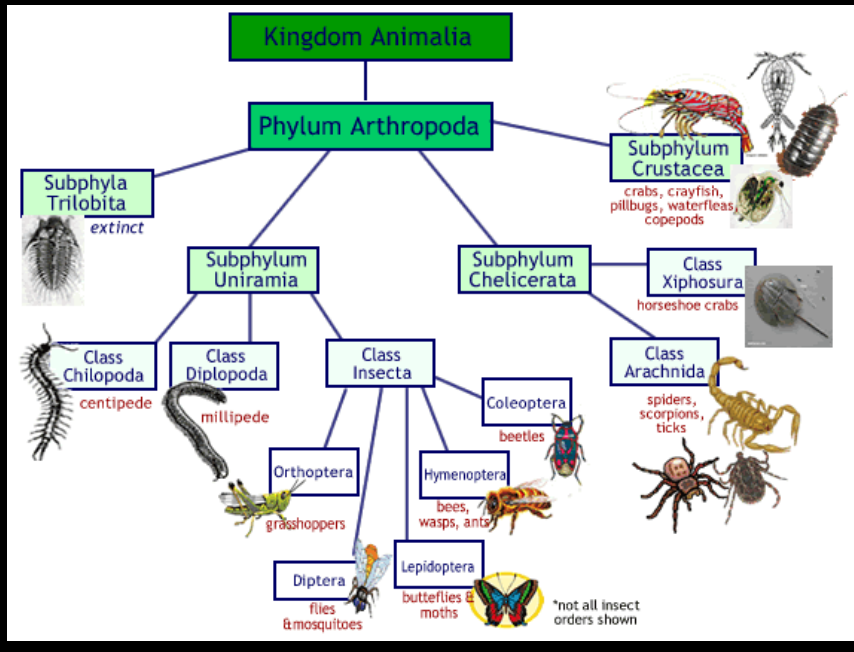

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Scorpions: Introduction

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

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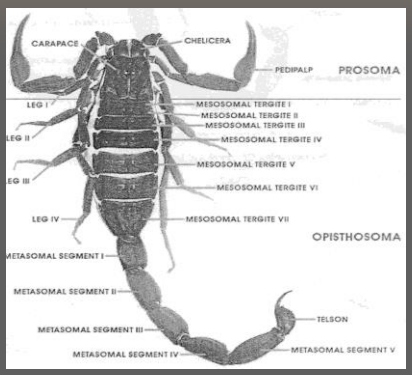
Scorpions: Introduction

Crablike body shape with 7 sets of paired appendages

Tail curves upward dorsally ending in terminal bulbous

Telson - contains paired venom glands and stinger



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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

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Scorpions: Venom

Contains several enzymes, neurotoxins, serotonin and histamine

Neurotoxin causes two effects:

- Incomplete inactivation of sodium channels during depolarization
- Inward sodium current after repolarization

Net result: repetitive axonal firing, enhancing release of neurotransmitters at synapses/NM junctions

Net effect: excessive neuromuscular activity and autonomic dysfunction

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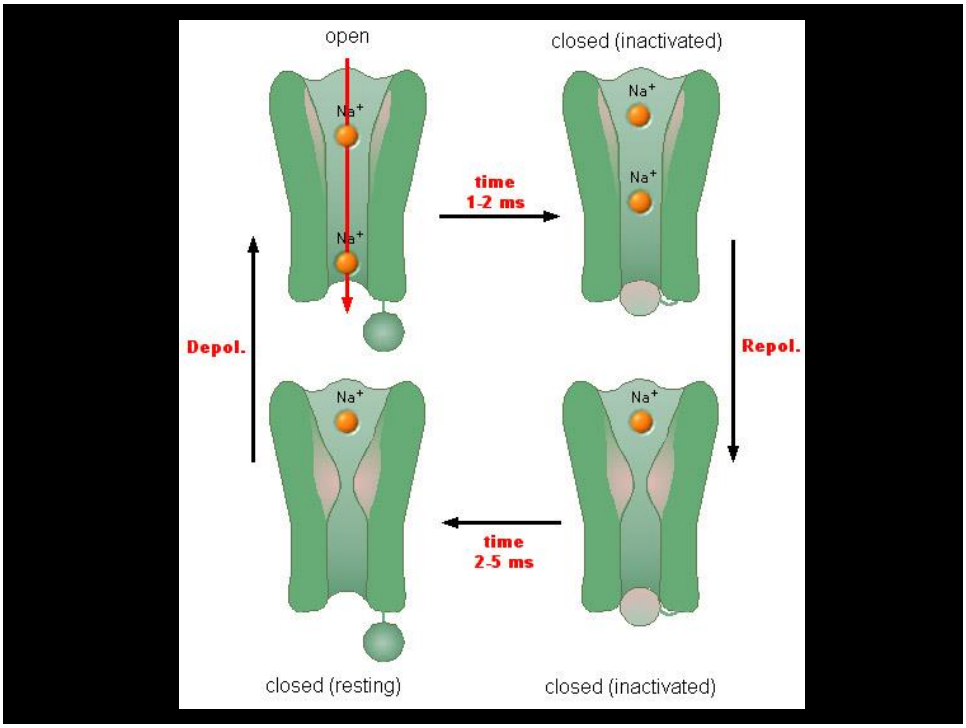

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Centruroides Sculpturatus

Of 40 species found in US, only *C. exilicauda* causes significant number of systemic reactions and is 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 our poison center

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Centruroides Sculpturatus:

Relatively small (5 cm)

Uniformly yellow/tan

Pincers/tail thin, streamlined

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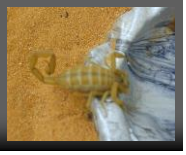
C. Sculpturatus: Envenomation

Grade I: Local pain and/or paresthesias at site of envenomation

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

Grade III: Cranial nerve dysfunction *or* somatic skeletal neuromuscular dysfunction

Grade IV: CN *and* skeletal neuromuscular dysfunction



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Box 35-2 CENTRUROIDES EXILICAUDA ENVENOMATION, AS REPORTED BY AN INTENSIVE CARE SPECIALIST

Arriving home in the early evening, I decided to go for a run. My running shoes were in the kitchen area, where I had left them the day before. As usual, I would wear my shoes without socks. As I put my left foot into the shoe, I felt an intense burning pain on the dorsum of my first toe. I pulled my foot out of the shoe and along with it came a 1½- to 2-inch, clear-brown scorpion.

Having no idea what to do for a scorpion envenomation, I called the poison control center. I was informed that the systemic toxicity was usually mild for someone my age, and that if the pain was too severe, I should come in and be evaluated. As the minutes went by, I began to salivate and feel perioral paresthesias. As I walked, the paresthesias became more generalized, with a very noticeable paravertebral tingling with each step. After a few more minutes, I decided to call the poison control center to ask for advice. After dialing the number, I was unable to speak clearly because of severe dysarthria and excess salivation. The toe pain seemed to abate as other neurologic symptoms developed.

Since I was unable to talk on the phone, and no neighbors were home to drive me to the hospital, I decided to drive myself. The normal 10-minute drive took 45 minutes. I had coordination difficulties with the gas pedal, clutch, and gear shifting. It was also nighttime, and I could not process the multiple visual inputs of car lights, street lights, and road lines in a way that would allow me to drive more than 5 to 10 miles per hour. I not only had to stop frequently and close my eyes for a few seconds but also had difficulty keeping the car in my driving lane.

After arriving at the emergency department, I was ataxic, dysarthric, and drooling and had difficulty giving the admitting nurse a proper history. I'm certain that I was thought to be either mentally retarded or intoxicated. Examination by the ED physician revealed many abnormal cerebellar findings, continued salivation, inability to swallow liquids, continued symptomatic paresthesias, but no objective motor or sensory deficits. There were no physical signs of envenomation [at the sting site], but tapping the toe produced worsening pain. As my story became clearer to the ED physician, antivenom was ordered and administered. Within 20 minutes of finishing the infusion, all neurologic signs and symptoms were gone, except for toe pain.

Personal account of Dr. Thomas Bajo, Phoenix, Arizona.

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C. Sculpturatus: : Treatment

Local: Observe for progression, symptomatic treatment

ABCs

Analgesia – fentanyl (1-2 mcg/kg IV)

Sedative Hypnotics – midazolam (0.05 – 0.1 mg/kg)

Continuous pulse oximetry and monitoring

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C. Sculpturatus: : Treatment

Systemic progression → Antivenom

Historically

- **Goat-derived Antivenin (Phoenix)**
  - **Risks: Hypersensitivity, serum sickness**

Anascorp®

- **Risks: Hypersensitivity**
- **Benefits: Likely discharge from ED, rapid improvement**
- **Made in Mexico, FDA approval in 2011**
- **3 vials over 15 minutes; re-eval q30 minutes (max: 5 vials)**

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Black Widow: Introduction

Genus Latrodectus

Females 12-16mm thorax

Female shiny black with red hourglass on ventral abdomen

Habitate barns, garages, trash heaps, outbuildings

Worldwide distribution

Every U.S. state except Alaska

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Black Widow: Venom

Minimal local effects or inflammation

Neurotoxin, α-latrotoxin, releases neurotransmitter

Involves calcium and non-calcium mediated activities; membrane pore formation

Specific for presynaptic receptor of motor end plates; releasing acetylcholine and norepinephrine

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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

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Black Widow: Clinical Presentation

Neuromuscular signs/symptoms
- Within 30-60 minutes
- Involuntary spasm/rigidity of abdomen/limbs/back
- 'Acute abdomen'
- Fasciculations
- Weakness
- Ptosis
- Priapism
- Respiratory muscle weakness

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Black Widow: Clinical Presentation

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

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

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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

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Black Widow: Treatment

Antivenom

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

Old Antivenom

- Single vial V over 30 minutes (100mL of NSS)
- No skin testing
- Have epinephrine at bedside

New Antivenom

- Experimental BioClon product Aracmyn PLUS®

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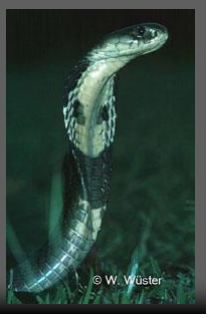
N. American Venomous Snakes

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



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Viperidae

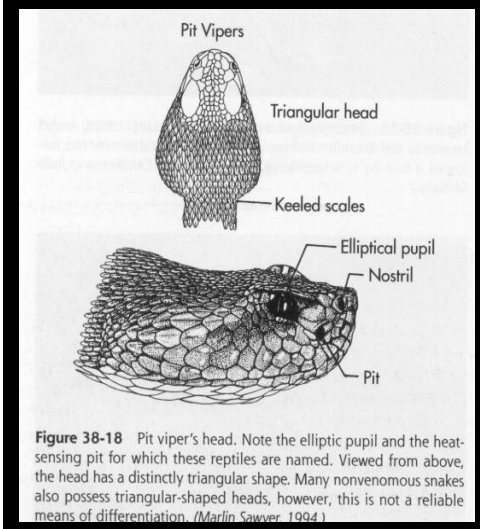

Figure 38-18 Pit viper's head. Note the elliptic pupil and the heat-sensing pit for which these reptiles are named. Viewed from above, the head has a distinctly triangular shape. Many nonvenomous snakes also possess triangular-shaped heads, however, this is not a reliable means of differentiation. *(Marlin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

- Paired pits
  - Thermoreceptor organs
  - Locate prey
  - Aim strikes
  - Adjust venom dose
  - Detect T change 0.003°C
- Elliptical pupil
  - Most harmless snakes round

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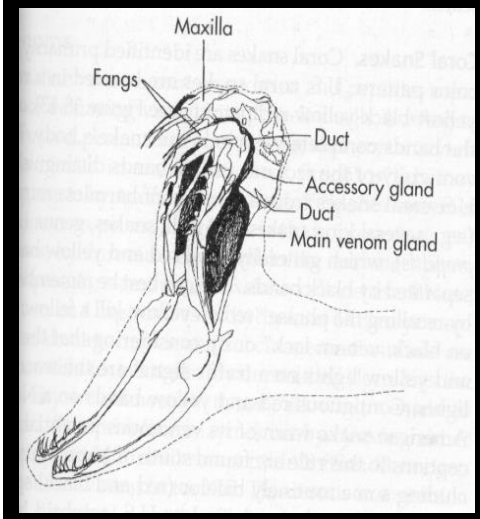
Viperidae: Venom Delivery



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"

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Rattlesnake: Shake, rattle, roll

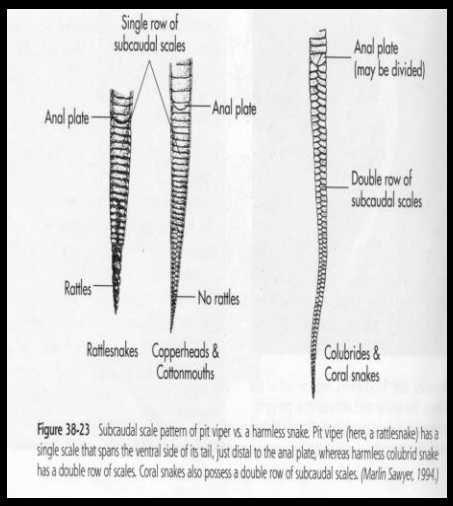

Figure 38-23 Subcaudal scale pattern of pit viper vs. a harmless snake. Pit viper (here, a rattlesnake) has a single scale that spans the ventral side of its tail, just distal to the anal plate, whereas harmless colubrid snake has a double row of scales. Coral snakes also possess a double row of subcaudal scales. (Marlin Sawyer, 1994.)

Rattle
- Loosely interlocked plates of keratin
- Emits buzzing sound when vibrated
- New segment added each shedding

Subcaudal scale pattern
- Single Row = venomous
- Double Row = nonvenomous

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Viperidae: Regional Species

Timber Rattlesnake (*crotalus h. horridus*)
- Canebrake

Eastern Massasauga (*Sistrurus catenatus*)

Copperhead (*Agkistrodon contortrix*)

Water Moccasin (Cottonmouth - *A. piscivorus*)

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Viperidae: Venom

Complex mixture enzymes, metals
- Proteolytic enzymes
- Hyaluronidase
- Phospholipase A_2
- Thrombin-like enzymes
- Collagenase
- Rnase
- Dnase

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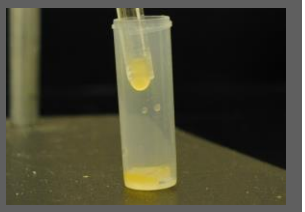
Viperidae: Venom Effects

Tissue injury
- Most common complication
- Enzymes breakdown tissue
- Disrupt capillary endothelium
- Necrosis of skeletal muscle



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

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Viperidae: Venom Effects

Cardiovascular toxicity
- Hypotension- vomiting/hemorrhage
- Myocardial depressor protein

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

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Viperidae: Clinical Presentation

Local

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

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Viperidae: Clinical Presentation

Systemic effects

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

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Viperidae Bite: Management

Prehospital: Control bleeding

Elevate and immobilize effected limb
(non-compressive splint)

NO ice/tourniquet/suction kits

Get to the antivenom

Analgesia/antiemetics/tetanus
- Fentanyl

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Viperidae Bite: Management

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

No evidence of envenomation in ED - discharge

Envenomation - admit

Leg bites: effects can be delayed - admit

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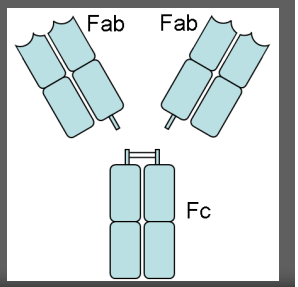
Viperidae Envenomation

Antivenom
- CroFab

Fluid replacement/analgesia

Wound care
- R/O Compartment syndrome
- Simple debridement
- Dermotomy / fasciotomy



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Antivenom Adminsitration

CroFab

Indicated with significant envenomations
- Progressive edema
- Coagulopathy
- Shock

Skin testing not routinely suggested

Low risk for anaphylaxis

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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 and increase to 250 mL/hr

Evaluate for "Control" of envenomation

Recheck platelets, PT, fibrinogen and evidence of edema progression

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CroFab Antivenom

If "not controlled" re-administer 4 to 6 vials and then repeat testing

If "control" achieved:

- 2 vials every 6 hours for three doses
- Each dose over one hour
- Recheck labs within 4 hours after 3rd dose
- Subsequent dosing based on P.E. and lab data

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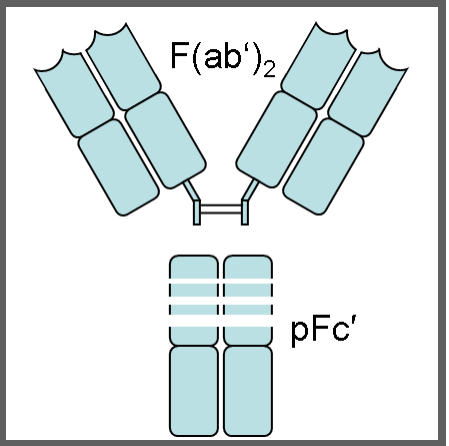
Antivenom Experimental

Bioclon's Anavip®

F(ab)2 molecule

Large molecular weight

Less immunogenic



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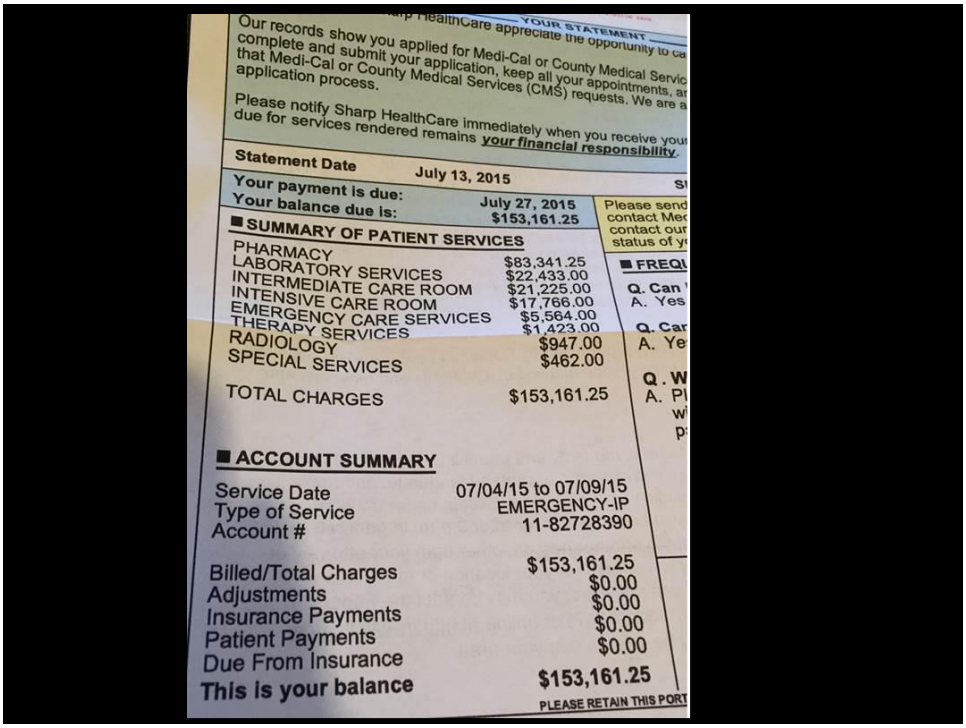

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Africanized Bees

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

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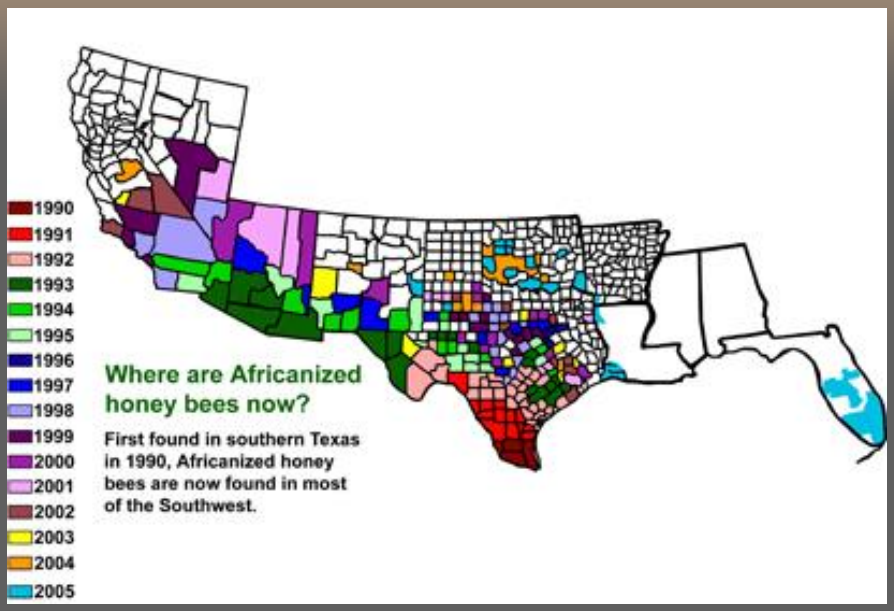

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Africanized Bees

Large populations

Frequent swarming

Long, nonstop flights (>20km)


Killer Bees are slightly smaller than the European honey bee, but only an expert can tell them apart

Tendency toward mass attacks after minimal provocation, chase victims

"Killer bees" more aggressive

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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

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Africanized Bees: Venom

Phospholipase A_2

- Increases capillary permeability

Morbidity associated with *cumulative venom dose*

>100 major systemic toxicity likely

Estimated human lethal dose ~ 20 stings/kg

(~1500 stings in an adult)

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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

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Africanized bee attack killed man in Carefree

Agriculture Department warns public of hazards

By Robbie Sherwood
Tribune writer

The bees that attacked and killed a Carefree man were Africanized honeybees — the so-called "killer" bees — an official at the State Department of Agri-

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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

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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

High risk: pediatrics, elderly, comorbidities

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Gila Monster

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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

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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

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Gila Monster

Venom

- Kallikrein-like substances
- Hyaluronidase
- Protease
- Phospholipase A_2
- Serotonin

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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

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Gila Monster: Management

ABCs and **Detach lizard!**

Irrigate wound

Wound care, radiograph

Pain control, tetanus, antibiotics not routinely required unless evidence of infection

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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

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Blackwidow - Treatment

Consider the diagnosis
(elderly and children)

Follow BP, ? ECG

Pain medications

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Rattlesnake - Treatment

Immobilize Limb
(straight, non-compressive splint)

No Tourniquet or Ice

IVFs (in non-effected limb)

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Bees - Treatment

ABCs - Secure airway

IVFs

Anaphylaxis? (Epinephrine)

Don't Focus on the Stingers

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Gila Monster - Treatment

Detach animal if its safe

Irrigate / Clean Wound

Pain medications

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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

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Handout - daniel.brooks@bannerhealth.com

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